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Financial and manpower data on research, development and instruction in the sciences and engineering in universities and colleges and in university-administered federally funded Research and Development Centers are reported. Information was obtained from analyses of questionnaires sent to each university. Field visits and telephone followups were continued up to December 15, 1965, the cutoff date for the report. Each institution was asked for information on the scientific activities of all its branches and other units both on and off the main campus. Separate data were requested for 89 medical schools and 59 agricultural experiment stations. The data are reported in seven sections. Sections 1, 2, and 3 analyze expenditures for research, development, and instruction in the sciences and engineering. Sections 4 and 5 summarize employment data on scientific and engineering personnel. Section 6 discusses medical schools; section 7, agricultural experiment stations and schools of agriculture. (BC)

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Scientific Activities at Universities and Colleges

1964

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Surveys of Science Resources Series

NATIONAL SCIENCE FOUNDATION

NSF 68—22

Scientific Activities at Universities and Colleges

1964

A Final Report on a Survey of 1964 Financing and January 1965 Employment in the Sciences and Engineering

Surveys of Science Resources Series

NATIONAL SCIENCE FOUNDATION

NSF 68—22

FOREWORD

THE RESULTS OF THE National Science Foundation's Survey of Scientific Activities of Universities and Colleges in 1964 were summarized in the NSF *Reviews of Data on Science Resources,* No. 9, August 1966. This report provides subsequent analysis of the data as well as more detailed information. The survey provided general-purpose data on the financial and manpower resources used for research, development, and instruction in the sciences and engineering, and was somewhat broader in the scope of scientific activities covered than previous NSF surveys of universities and colleges.

Periodic NSF studies of the financial and manpower resources allocated to scientific activities in universities and colleges provide information needed by officials in government, education, industry, and other organizations concerned with developing policies and programs to strengthen academic capabilities for science. These studies together with similar NSF studies of industry, government, and other nonprofit institutions yield national data on the financial and manpower resources allocated to scientific and engineering activities.

The impacts of scientific and technological achievements on virtually every aspect of social living have stimulated considerable public interest on questions related to the adequacy of present and future deployment of financial and manpower resources in the sciences and engineering in the United States. Such questions are particularly relevant to the Nation's universities and colleges, which have always been heavily dependent upon both public and private financial support. As is well known, income from tuition and other student charges covers only a small part of the total financial outlays of public and private institutions of higher education. Now, as in the past, universities and colleges are faced with a continuing problem of acquiring new and expanded sources of income to meet the increased demands placed upon them for education, research, and public service. The pressures of increased enrollments and demands for excellence in all disciplines have manifested themselves in greatly increased financial burdens for higher education. Achieving and maintaining excellence present particularly formidable problems in the scientific and engineering disciplines, where research and education, especially at the graduate level, require heavy outlays to recruit and retain highly qualified faculty and to purchase and maintain expensive materials, equipment, and facilities.

Policies and programs to assist universities and colleges to develop and maintain strong academic capabilities in the sciences and engineering are of deep concern to the community at large, including all levels of government, industry, and private organizations and individuals. It is generally recognized that the future scientific and technological potentials of the economy are closely linked with the strength and vitality of the Nation's universities and colleges. Information on financial and manpower resources required for education and research in the sciences and engineering is needed by decision-makers, both inside and outside government, who are responsible for developing programs and policies to meet the future scientific and technological requirements of the economy. Knowledge of requirements of the present and the immediate past provides a benchmark for gauging future needs and for the development of programs to meet those needs.

The report on the 1964 survey was prepared in the National Science Foundation's Office of Economic and Manpower Studies, H. E. Riley, Head. Assistance in compiling the mailing list and other aspects of the survey provided by officials of the U.S. Office of Education is gratefully acknowledged. The National Science Foundation also expresses its appreciation to officials of universities and colleges who provided the survey data upon which this report is based.

CHARLES E. FALK
Planning Director
National Science Foundation

May 1968

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This report was prepared in the Office of Economic and Manpower Studies under the guidance of Kenneth Sanow, Head, Statistical Surveys and Reports Section. The survey was conducted and the report prepared under the direction of Joseph H. Schuster, Study Director, Universities and Nonprofit Institutions Studies Group. J. G. Huckenpahler assisted in the conduct of the survey and in preparing this report. Among the former staff members who contributed to survey operations were Hyman Steinberg, George H. Wade, Spyros C. Papachristos, Meyer Harron, and Luwiena E. Tinkelenberg.

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DEFINITIONS

Universities and colleges include institutions of higher education in the United States and its territories offering at least a 2-year resident program of college-level studies and meeting criteria for listing in directories of higher education published periodically by the U.S. Office of Education. As defined for this report, "universities and colleges" include all organizational units of such institutions except university-administered FFRDC's, which are described below.

University-administered Federally Funded Research and Development Centers (FFRDC's) are organizations exclusively or substantially financed by the Federal Government, in most instances established to meet an R&D need of the Federal Government, and administered by individual universities or university consortia. (List for academic year 1963–64 shown in appendix B.)

Current R&D expenditures include both direct and indirect costs of research and development in the sciences and engineering performed by universities and colleges. Included are separately budgeted research and development, for which universities and colleges normally maintain precise records, and the estimated expenditures for departmental research and unreimbursed indirect costs of sponsored research, for which most institutions do not maintain records.

Current expenditures for separately budgeted research and development refer to R&D projects for which exact accountability for expenditures is maintained by universities and colleges. Such expenditures are made from funds specifically designated for R&D performance through gifts, grants, and contracts, or earmarked for such a purpose by the university or college.

Current expenditures for instruction and departmental research include all direct and indirect expenditures incurred in instructional programs for resident, degree-credit courses of study in the sciences and engineering. Included are salaries of department heads, faculty members, and secretaries and technicians; costs of office and laboratory materials and supplies; and other direct and indirect expenses. The departmental research portion was defined for this survey as research that is carried on in connection with the teaching function and is funded without separate financial records in the departmental budgets rather than being allocated from restricted funds, as defined above for separately budgeted research.

Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction include funds for facilities that were in process or completed in academic year 1963–64. Facilities and equipment are defined to include buildings, fixed equipment, movable furnishings, architects' fees and related costs, and special separate facilities to house scientific apparatus.

Scientists and engineers include employees of an institution who have received a bachelor's degree, or have the equivalent in training or experience, and are working at a professional level (a level at which knowledge at least equivalent to that obtained in a 4-year bachelor's degree program is essential to the performance of duties in the sciences or engineering).

NOTE: Other and more detailed definitions are included in the survey instructions in appendix C.

SUMMARY[1]

Total Expenditures for Scientific Activities in Universities and Colleges

Current and capital expenditures of universities and colleges for research, development, and instruction in the sciences and engineering amounted to $4.0 billion in 1964. Their current expenditures for the sciences and engineering totaled more than $3.4 billion; capital expenditures, $530 million.

Most of these current and capital expenditures (88 percent) were concentrated in 400 institutions granting graduate degrees in the sciences and engineering, including associated medical schools and agricultural experiment stations. The total number of universities and colleges surveyed was 1,942.

The largest share of the total current and capital expenditures went to the life sciences, with 43 percent. Next were the physical sciences (24 percent), engineering (13 percent), social sciences (13 percent), and other sciences (7 percent).

Current R&D Expenditures[2]

Over two-fifths of the current expenditures for scientific activities (research, development, and instruction) in 1964 were for research and development, amounting to $1.6 billion. This represented an average increase of 16 percent per year from the $377 million spent in 1954. In 1964, the Federal Government provided 58 percent of these funds; in 1954, 42 percent.

Almost four-fifths of the current R&D expenditures in 1964 were for basic research, amounting to $1.3 billion, for an average (compound rate) increase of 20 percent per year from $206 million in 1954. Basic research expenditures amounted to 79 percent of the total current R&D expenditures in 1964, compared with 55 percent in 1954. Although universities and colleges performed only 8 percent of the Nation's R&D total in 1964, they accounted for nearly one-half of the basic research performed.

The life sciences accounted for 53 percent of the $1.6 billion total for research expenditures by universities and colleges, followed by the physical sciences (23 percent), engineering (12 percent), and the social sciences (7 percent). The relatively heavy expenditures in the life sciences overall were largely the result of their predominance in medical schools and agricultural experiment stations.

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[1] In this summary and throughout this report, financial and manpower characteristics of the scientific activities of universities and colleges and university-administered Federally Funded Research and Development Centers (FFRDC's) are shown separately.

[2] Includes separately budgeted R&D expenditures and estimated expenditures of $322 million for R&D activities, for which most universities and colleges do not maintain exact records.

Current Expenditures for Instruction

Universities and colleges expended $1.8 billion for instruction in the sciences and engineering in 1964. Of this total, institutions granting graduate degrees in the sciences and engineering expended 80 percent.

The life sciences accounted for the largest share of the expenditures (35 percent), followed by the physical sciences (23 percent), social sciences (19 percent), and engineering (14 percent).

Capital Expenditures for Scientific and Engineering Facilities and Equipment

The expenditures for scientific and engineering facilities and equipment for research, development, and instruction in universities and colleges totaled $530 million in 1964. Institutions granting graduate degrees in the sciences and engineering accounted for 85 percent of these capital expenditures.

Non-Federal sources provided 75 percent of the total capital expenditures for these purposes. Of these non-Federal expenditures, 54 percent were for undergraduate instruction in the sciences and engineering. In contrast, 80 percent of the Federal Government's support of capital expenditures was for research and development and graduate instruction in the sciences and engineering.

The life sciences accounted for the largest portion (44 percent) of the capital expenditures for science and engineering, followed by the physical sciences (29 percent), engineering (14 percent), and social sciences (6 percent).

Employment of Scientists and Engineers

The number of scientists and engineers employed full time and part time in universities and colleges totaled 189,600 in January 1965, which represented an increase at a compound annual rate of 7 percent during the past 7 years. In addition, 60,400 graduate students were paid for part-time work in the sciences and engineering, such as teaching assistants and research assistants. The number of graduate students working in the sciences and engineering increased at a rate of 11 percent per year during the period 1958-65.

In full-time-equivalent terms, including the work of graduate students engaged in scientific and engineering activities, universities and colleges employed 192,600 scientists and engineers in January 1965. Of these, 61 percent were engaged in teaching; 29 percent, research and development; and 10 percent, other activities.

Federally Funded Research and Development Centers (FFRDC's) Administered by Universities

Current and capital outlays for research, development, and graduate instruction in the sciences and engineering in FFRDC's totaled $776 million in 1964. These expenditures were distributed as follows: separately budgeted research and development, 81 percent; capital expenditures, less than 19 percent; and instruction, an almost negligible proportion amounting to 0.2 percent.

The $629 million for separately budgeted research and development in 1964 was five times the comparable figure for 1954. The expenditures increased at an annual rate of 17 percent during the 10-year period.

By character of work, 38 percent of the separately budgeted R&D expenditures were for development; 32 percent, applied research; and 30 percent, basic research.

Of the $393 million spent for research by FFRDC's in 1964, the physical sciences accounted for 81 percent, followed by engineering, 10 percent; life sciences, 8 percent; and psychology, 1 percent.

In capital expenditures, the physical sciences accounted for 84 percent of the $147 million total, followed by engineering (11 percent) and the life sciences (5 percent).

Federally Funded Research and Development Centers employed 11,700 scientists and engineers in January 1965, nearly all of whom were primarily engaged in research and development. Physical scientists accounted for 49 percent of this total, and another 44 percent were engineers. All other fields of science combined made up only 7 percent.

INTRODUCTION

NO SECTOR OF THE economy has been more deeply affected than the Nation's universities and colleges by the challenge and opportunities resulting from recent decades of scientific and technological achievements. These institutions necessarily occupy a pivotal position in our knowledge-oriented society, in which public demand for increased educational services has continued to expand.

Since World War II, universities and colleges have had to accommodate greatly increased enrollments of undergraduate and graduate students, have met growing pressures for the extension of the frontiers of knowledge in the national interest, and have taken on progressively more public service functions related to science and technology, medicine and health, social problems, economic development, and other areas of public concern. At the same time, these institutions have been hard pressed to compete for the faculty and other professional personnel and to build and maintain the physical plant required for all of these greatly expanded responsibilities.

How well the universities and colleges can carry out these responsibilities depends to a great extent upon how much public and private support they can command. Information on the deployment of scientific and engineering resources in these institutions, together with trends in the utilization of the resources, is important to the National Science Foundation and other Federal agencies concerned with developing policies and programs to strengthen academic science capabilities. Officials in State and local governments and in educational and other organizations concerned with the advancement of science and technology also require such information. Furthermore, public awareness of the importance of science and technology to economic growth, health and welfare, and national security has engendered widespread public interest in all matters related to scientific and engineering activities, including those in the institutions of higher education.

In the years since it was established in 1950, the National Science Foundation has conducted or sponsored numerous comprehensive studies of financial and manpower resources utilized in scientific and engineering activities in all sectors of the economy. This is the final report on the Foundation's Survey of Scientific Activities of Institutions of Higher Education, 1963-64. The survey obtained information on current and capital expenditures and scientific and technical personnel allocated to scientific and engineering activities in universities and colleges. A preliminary report summarizing the results of the survey was issued earlier.[1] Similar studies were made in 1954 and 1958; a survey covering scientific and technical personnel only was made in 1961.[2]

Scope and Method

This report pertains to financial and manpower data on research, development, and instruction in the sciences and engineering in universities and colleges and in university-administered Federally Funded Research and Development Centers.

Information for the study was obtained by mail questionnaires sent to each university or college president, who was asked to designate an official to respond for all divisions of his institution. The questionnaires were mailed by the National Science Foundation in February 1965, followed by mailings to nonrespondents in both May and July 1965. Field visits to certain academic institutions and telephone follow-ups to nonrespondents and institutions that submitted incomplete reports continued up to December 15, 1965, the cutoff date for this report.

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[1] National Science Foundation, *Reviews of Data on Science Resources*, No. 9, "Resources for Scientific Activities at Universities and Colleges, 1964," NSF 66–27. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, August 1966.

[2] National Science Foundation, *Scientific Research and Development in Colleges and Universities—Expenditures and Manpower, 1953–54*, 1959; *Scientific Research and Development in Colleges and Universities—Expenditures and Manpower, 1958*, 1963; and *Scientists and Engineers in Colleges and Universities, 1961*, 1965. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office.

The survey universe, based on the *Education Directory, 1963-64, Part 3, Higher Education,*[3] was the 1,942 institutions of higher education in the United States and its territories with programs in the sciences and engineering. Excluded were about 250 independent schools of music, art, theology, law, and other specialized institutions that do not normally maintain science and engineering programs. Each surveyed institution was asked to provide information on the scientific activities of all its branches and other units both on and off the main campus. The survey requested separate data for 89 medical schools and 59 agricultural experiment stations in operation in 1964. Of the experiment stations, 58 were affiliated with schools of agriculture; the other, the Connecticut Agricultural Experiment Station at New Haven, was included although not affiliated with an institution of higher education in order to obtain complete data for all agricultural experiment stations.

Institutions granting graduate degrees were asked to complete relatively detailed questionnaires; liberal arts colleges, junior colleges, and specialized institutions not granting degrees were sent an abbreviated version for similar but less detailed information. Information from various sources, including previous surveys by the National Science Foundation and the U.S. Office of Education, indicated that these latter institutions conducted relatively little research, development, and instruction in the sciences and engineering.

The survey questionnaire took into consideration the business and accounting practices and procedures of universities and colleges. When possible, terms used were those established by the American Council on Education and other educational associations.[4] Expenditures data covered either the fiscal year July 1, 1963, to June 30, 1964, or the institution's comparable fiscal year. Manpower data were reported as the number employed in mid-January 1965, or as close to that date as feasible.

Of the total 1,942 institutions that were sent questionnaires, 1,600 (82 percent) returned usable data. In general, response proved adequate for all items except those dealing with curriculum and course content improvement and with restricted funds for instruction and departmental research (appendix C, items 10 and 11 in the detailed questionnaire, 8 and 9 in the abbreviated version). To estimate the data for the nonrespondent institutions and for institutions that did not submit complete reports, published and unpublished data from the following sources were used: U.S. Office of Education, Federal agencies' reports on financial support of educational institutions, and the academic institutions' own bulletins, catalogs, and financial reports.

Relationship to Other Surveys

This survey differed from previous NSF surveys of scientific activities of universities and colleges in a number of details. For example, the 1954 and 1958 surveys covered both R&D expenditures and the employment of scientific and technical personnel; the 1961 survey, manpower alone.

Related surveys include the U.S. Office of Education's *Financial Statistics* series[5] and the National Science Foundation's CASE report.[6] Both of these reports are confined to financial data, and neither gives separate data for departmental research. In addition, the OE *Financial Statistics* reports do not separate expenditures of universities and colleges from those of the FFRDC's, and no distinction is made between expenditures in the sciences and engineering and those in the arts and humanities. Data in the CASE report differ from those presented here in that the figures in the CASE report refer to funds obligated to universities and colleges by the various Federal agencies rather than to actual expenditures by the universities and colleges from all sources of financing, Federal as well as non-Federal.

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[3] U.S. Department of Health, Education, and Welfare, Office of Education, *Education Directory, 1963–64, Part 3, Higher Education,* OE 50000–64. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1964.

[4] A principal source was *College and University Business Administration,* Vol. 1. Washington, D.C.: American Council on Education, 1952.

[5] U.S. Department of Health, Education, and Welfare, Office of Education, *Financial Statistics of Institutions of Higher Education: 1959–60,* OE–50023–60. Washington, D.C., 20402: Supt. of Documents, U.S. Government Printing Office, 1964.

[6] A survey was undertaken for the Committee on Academic Science and Engineering (CASE), Federal Council of Science and Technology, by the National Science Foundation. *Federal Support to Universities and Colleges, Fiscal Years 1963–66,* NSF 67–14. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1967.

Limitations

Since the survey covered all universities and colleges that were known or thought to have science and engineering programs, estimates are not subject to a sampling error. They are, however, subject to limitations attributable to such factors as survey nonresponse or failure of respondents to interpret or apply survey definitions in the same way.

Since most of the 342 nonrespondent institutions had relatively small science and engineering programs, errors attributable to estimating their activities are believed to be small also (less than 1 percent of national aggregates). In all cases of nonresponse, available secondary sources of information were used in estimating data for this report. Estimates also were made for nonresponse to items on individual questionnaires. Thus, the data in this report represent, within reasonable error limits, totals for the higher education sector of the economy.

Perhaps the main limitation of statistical measures of scientific activities results from difficulties encountered by respondents in interpreting and applying survey definitions. Records available at many institutions of higher education do not readily provide exact information on financial and manpower resources allocated to "scientific activities," as defined for survey purposes. If exact information was not available, respondents were asked to supply estimates, which no doubt varied somewhat in accuracy.

The magnitude of response error attributable to lack of records and to difficulties in interpreting or applying the definitions cannot be precisely estimated. However, institutional accounting procedures, particularly in universities with large science and engineering programs, yield relatively accurate data on the disposition of restricted funds, such as separately budgeted research and development.

Plan of Report

Data on the scientific activities of universities and colleges are presented in seven sections of this report. Sections 1, 2, and 3 analyze expenditures for research, development, and instruction in the sciences and engineering. Sections 4 and 5 summarize data on the employment of scientific and engineering personnel. Section 6 discusses medical schools; section 7, agricultural experiment stations and affiliated schools of agriculture. In addition, the report contains summary data on the scientific and engineering activities of Federally Funded Research and Development Centers administered by universities and university consortia.

TOTAL EXPENDITURES FOR SCIENTIFIC ACTIVITIES IN UNIVERSITIES AND COLLEGES

CURRENT AND CAPITAL EXPENDITURES for research, development, and instruction in the sciences and engineering totaled nearly $4.0 billion in 1964 (table 1). These expenditures represented about 36 percent of total outlays for all activities of universities and colleges, which, according to the U.S. Office of Education, amounted to about $11.0 billion in 1964.[1]

The $4.0 billion expended in the sciences and engineering was allocated for the following principal categories: current expenditures for research and development, 40 percent; current expenditures for instruction, 46 percent; and capital expenditures for research, development, and instruction, 13 percent (table 1).[2]

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[1] Estimated current and capital expenditures totaling $11.8 billion in institutions of higher education in 1964 were adjusted downward to exclude the expenditures of university-administered FFRDC's amounting to $0.8 billion. Data on total current and capital expenditures of institutions of higher education are shown in the U.S. Office of Education, *Projections of Educational Statistics to 1975–76*, OE–10030–66 (Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1966), pp. 87 and 88.

[2] Estimated departmental research expenditures and unreimbursed indirect costs are grouped with R&D figures rather than with "instruction" as in the accounting systems of most institutions of higher education.

TABLE 1.—*Expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by type of expenditure, 1964*

(Dollar amounts in millions)

Total institutions and type of expenditure	Total	Institutions granting graduate degrees [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Number of institutions	1,942	400	1,542	89	59
Total expenditures	$3,959.1	$3,488.1	$471.0	$807.1	$332.2
Current research and development	1,594.8	1,564.8	30.0	437.9	235.7
Separately budgeted	1,272.4	1,259.6	12.8	351.1	208.7
Other [b]	322.4	305.2	17.2	86.8	27.0
Current expenditures for instruction [c]	1,834.8	1,472.7	362.1	263.6	67.1
Capital expenditures	529.5	450.6	78.9	105.6	29.4
Research, development, and graduate instruction	289.0	281.6	7.4	88.1	20.8
Undergraduate instruction	240.5	169.0	71.5	17.5	8.6

[a] In the sciences and engineering; includes the medical schools and agricultural experiment stations.

[b] Includes estimated expenditures for R&D activities for which most institutions do not maintain separate records: departmental research expenditures, $219.0 million, and unreimbursed indirect costs of sponsored research and development, $103.4 million.

[c] Excludes departmental research, above, which is normally funded through "instruction and departmental research" budgets of universities and colleges.

Overall statistics of 1964 current and capital expenditures point up a number of dominant features characterizing science and engineering activities in institutions of higher education irrespective of geographical location. Perhaps the most important is the concentration of scientific activities in the 400 universities and colleges granting graduate degrees[3] in the sciences and engineering. These institutions, about one-fifth of the 1,942 universities and colleges with programs in the sciences and engineering, accounted for the major share of all those activities in 1964: 98 percent of the current R&D expenditures, 80 percent of the current instruction expenditures, and 85 percent of the capital expenditures.

One factor contributing to the concentration of science and engineering activities in graduate institutions was the relatively heavy expenditures for science and engineering activities in 89 medical schools and 59 agricultural experiment stations,[4] all of which by definition are organizational components of graduate-degree-granting institutions. Current and capital expenditures of medical schools and agricultural experiment stations together amounted to $1.1 billion in 1964, or 29 percent of the comparable total for all units of universities and colleges.

The overall concentration of expenditures for scientific activities in the institutions granting graduate degrees in the sciences and engineering is a manifestation of the important role of these institutions in the Nation's structure of higher education. To fulfill their research, educational, and public service responsibilities, graduate institutions must necessarily have the financial resources to attract and hold qualified faculty and professional staff and to provide the facilities and equipment required to carry out high quality research and education. A similar observation might be made regarding the financial requirements of liberal arts and junior colleges. However, resources per student or per faculty member required for graduate education and basic research to extend the frontiers of knowledge in the sciences and engineering are somewhat greater than for undergraduate education. In this connection, it is noteworthy that the Nation's graduate institutions award annually three-fourths of the bachelor's degrees in the sciences and engineer-

TABLE 2.—*Expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by type of expenditure and broad field of science, 1964*

(Millions of dollars)

Type of expenditure	Total	Engineering	Physical sciences	Life sciences	Social sciences	Other sciences
Total expenditures [a]	$3,921.5	$523.2	$943.8	$1,703.2	$492.7	$258.7
Current research and development	1,557.2	192.8	364.6	821.0	116.6	62.3
Separately budgeted, research only [a]	1,234.8	156.6	293.5	660.1	78.9	45.7
Other [b]	322.4	36.2	71.1	160.9	37.7	16.6
Current expenditures for instruction [c]	1,834.8	258.7	425.7	650.2	343.5	156.7
Capital expenditures	529.5	71.7	153.5	232.0	32.6	39.7
Research, development, and graduate instruction	289.0	27.6	75.1	160.0	10.8	15.6
Undergraduate instruction	240.5	44.1	78.4	72.0	21.8	24.2

[a] Distribution by field of science of separately budgeted development activities totaling $37.6 million was not requested on the survey questionnaire.

[b] Includes estimated expenditures for R&D activities for which most institutions do not maintain separate records: departmental research expenditures, $219.0 million, and unreimbursed indirect costs of sponsored research and development, $103.4 million.

[c] Excludes departmental research, above, which is normally funded through "instruction and departmental research" budgets of universities and colleges.

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[3] As noted in subsequent sections, concentration of scientific and engineering activities is heaviest in the 180 institutions that grant doctorates in the sciences and engineering.

[4] The term "agricultural experiment stations," as used in this report, includes schools of agriculture and extension services, when these are controlled or administered by the State land-grant colleges and universities (see p. 27).

ing, as well as all of the master's degrees and doctorates.[5]

Another salient feature of scientific expenditures in universities and colleges is their relatively heavy orientation toward the life sciences, with more than two-fifths of current and capital expenditures for research and instruction in 1964. (See table 2.) Proportions represented by broad fields were as follows:[6]

Field	*Percent*
Total	100
Life sciences	43
Physical sciences	24
Engineering	13
Social sciences	13
Other sciences	7

The predominance of expenditures for the life sciences is due mainly to the scientific activities of medical schools and agricultural experiment stations, as noted in the preceding paragraph.

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[5] Based on data of the U.S. Office of Education.

[6] As noted in table 2, figures showing the distribution of expenditures, by field of science, exclude expenditures for development activities totaling $37.6 million, less than 1 percent of the total expenditures for scientific activities.

Section 1. Current Expenditures for Research and Development

Current expenditures for research and development in universities and colleges amounted to $1.6 billion in 1964 or 8 percent of the national total.[7] Of this amount, $1.3 billion was for separately budgeted research and development and $322 million for R&D activities of which institutions do not maintain separate records (table 1). The latter amount (not separately budgeted) included an estimated $219 million for departmental research and $103 million for unreimbursed indirect costs of sponsored research and development financed by the performing institutions from their own funds.

The main characteristic differentiating separately budgeted research projects and departmental research projects is the manner in which they are administered and reported in financial statements of universities and colleges. Separately budgeted R&D expenditures refer to expenditures for projects that are separately organized, budgeted, and financed; departmental research expenditures refer to the research performed in connection with the instruction function carried out in universities and colleges and funded through institution and departmental research budgets.[8] In subsequent sections of this report, analysis of R&D expenditures will be limited to separately budgeted R&D expenditures.[9]

The growth in the importance of R&D activities in universities and colleges is shown in greatly increased outlays over the past decade. From 1954 to 1964, R&D expenditures in universities and colleges increased from $377 million to $1.6 billion, or at an annual rate of 16 percent, somewhat higher than the annual rate of about 13 percent for the economy as a whole.

Increased Federal sponsorship was mainly responsible for the growth in R&D activities at universities and colleges during 1954–64. (See chart 1.) During the 10-year period, federally financed research and development increased from $160 million to $917 million, or at an annual rate of 19 percent; from non-Federal sources, an annual rate of 12 percent. The sizable increase in Federal R&D support during 1954–64 resulted in a somewhat altered pattern of R&D financing in universities and colleges. In 1954, the Federal Government's share amounted to 42 percent of the total, compared with 58 percent in 1964.

Another significant trend from 1954 to 1964 was the increase in basic research performance

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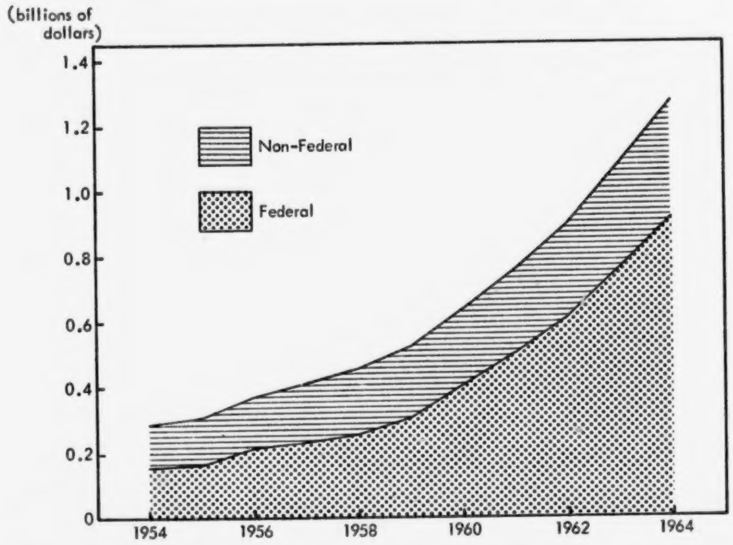
[7] National Science Foundation, *National Patterns of R&D Resources: Funds and Manpower in the United States, 1953–68*, NSF 67-7. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1967, pp. 22 and 23.

[8] A more detailed description of departmental research is given in section 2.

[9] Inasmuch as institutions of higher education maintain separate accounts for restricted funds, e.g., organized or separately budgeted research, they are able to provide relatively precise data on various characteristics of separately budgeted research and development.

Chart 1. Current R&D expenditures in universities and colleges, by source of funds, 1954-64



Source: National Science Foundation (appendix table A–1).

in universities and colleges. Expenditures for basic research rose from $206 million in 1954 to $1.3 billion in 1964, or at an annual rate of 20 percent. In exceeding the growth rates for applied research and development in these institutions, basic research rose from 55 percent of total R&D expenditures in 1954 to 79 percent of this total in 1964 (appendix table A–2).

During this same period, current expenditures for basic research by all sectors of the economy increased from less than 10 percent to 13 percent of total R&D expenditures.[10] Thus, with a faster growth rate in universities and colleges, their proportion of national basic research expenditures increased from 38 percent in 1954 to 49 percent in 1964.

Separately Budgeted Research and Development

Separately budgeted R&D expenditures in the sciences and engineering amounted to $1.3 billion in 1964, or 80 percent of the estimated $1.6 billion total for R&D expenditures.[11] As noted, "separately budgeted R&D expenditures" refer to outlays from restricted funds specifically earmarked for research and/or development—such as gifts, grants, or contracts from government, industry, and other private organizations—for which universities and colleges must maintain strict accountability. As a consequence, all universities and colleges are able to supply information on various characteristics of their separately budgeted R&D performance. This section analyzes distributions of such expenditures among selected groups of institutions, sources of funds, character of work, fields of science, geographical areas, and principal cost items.

Characteristics of Institutions

Of the 1,942 institutions surveyed, 636 performed separately budgeted research and development. These included 341 institutions granting graduate degrees in the sciences or engineering, 267 institutions granting bachelor's degrees in the sciences or engineering, 13 schools that did not grant science or engineering degrees, and 15 that granted no degree in any field.

The institutions with graduate-degree programs in the sciences and engineering have the greatest capability in faculty and facilities to perform separately budgeted research and development. In 1964, such institutions accounted for virtually all (99 percent) of the current expenditures for separately budgeted research and development. (See table 3.)

The Federal Government was the major source of R&D financing in institutional groups of all degree levels (table 3). Although in terms of the national total the R&D expenditures of institutions below the doctorate level were relatively small, it is noteworthy that the Federal Government financed 76 percent of the separately budgeted R&D work in institutions with the bachelor's degree as the highest granted in the sciences and engineering. In junior colleges and other institutions that did not grant science or engineering degrees, 66 percent of the separately budgeted research and development was federally financed.

Most academic administrators agree that separately budgeted R&D activities contribute substantial benefits to all levels of their academic programs, especially at the doctorate

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[10] National Science Foundation, *National Patterns of R&D Resources: Funds and Manpower in the United States, 1953–68, op. cit.*

[11] As noted earlier, R&D expenditures for which universities and colleges do not usually maintain separate records amounted to an estimated $322 million in 1964. Relatively little information is available on departmental research and other nonbudgeted research expenditures.

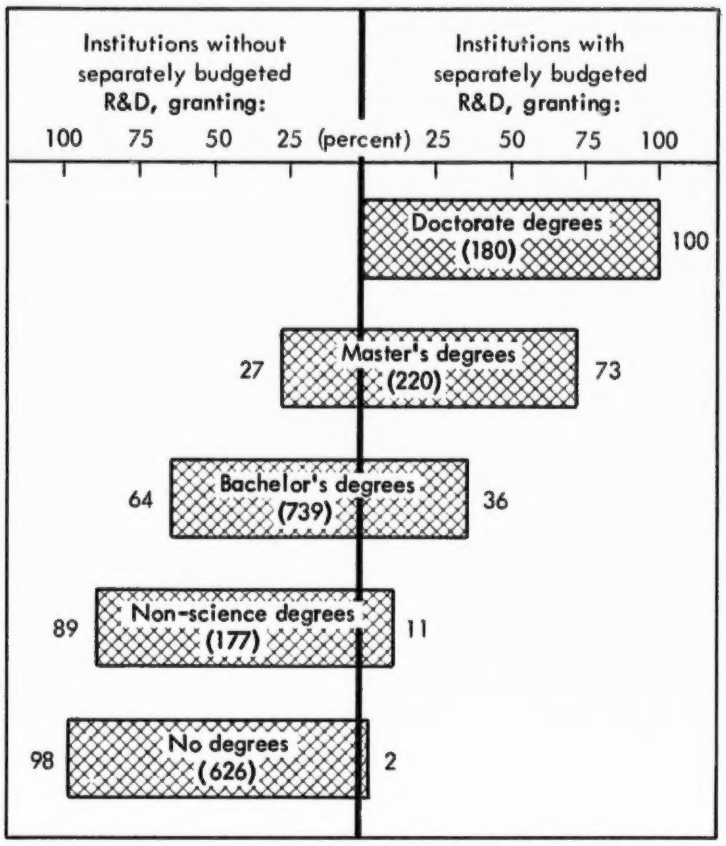
Table 3.—*Current expenditures for separately budgeted research and development in universities and colleges, by highest degree granted in the sciences and engineering, by source of funds, 1964*

(Dollar amounts in millions)

Institutions classified by highest degree granted in the sciences and engineering	Total amount	Federal Government		Non-Federal	
		Amount	As percent of total	Amount	As percent of total
Total	$1,272.4	$917.3	72.1	$355.1	27.9
Doctorate	1,225.1	885.0	72.2	340.1	27.8
Master's	33.4	22.2	66.5	11.2	33.5
Bachelor's	10.1	7.7	76.2	2.4	23.8
Less than bachelor's	3.8	2.5	65.8	1.4	36.8

level. This observation is borne out by the fact that in 1964 all doctorate-degree-granting institutions performed these R&D activities, compared with 73 percent of those offering master's degrees (but not doctorates) and 36 percent of those offering only bachelor's degrees in the sciences and engineering (chart 2). Institutions granting doctorate degrees also predominated in the amount of these expenditures—96 percent of the total. (See table 3.)

Chart 2. Distribution of universities and colleges performing separately budgeted research and development, by level of degrees granted, 1964[a]



[a] Universities and colleges were classified on the basis of highest level of degrees granted in the sciences and engineering.

Note: Number of institutions in parentheses.

Source: National Science Foundation.

Type of Control

Publicly controlled institutions, greater by far than privately controlled institutions in their total numbers of students and faculty, accounted for 55 percent of current expenditures for separately budgeted research and development (table 4). The Federal Government, major source of funds for both types of institutions, obligated 52 percent of its funds to private institutions. Foundations and voluntary health agencies, as would be expected, gave 62 percent of their funds to private institutions, mostly medical schools. And State governments heavily supported public institutions, mostly those with affiliated agricultural experiment stations.

Source of Funds

In contrast to the Federal Government's relatively small role in the support of capital expenditures and of instruction and departmental research in the sciences and engineering, the Government was the predominant source (with 72 percent) for separately budgeted R&D expenditures in 1964 (appendix table A–3). Federal support reflects the objective of many individual Federal agencies to utilize the experience and knowledge of university personnel to further their own programs. This academic resource has been valuable in scientific areas in which agencies have had limited capabilities.

TABLE 4.—*Current expenditures for separately budgeted research and development in universities and colleges, by source of funds and type of control, 1964*

(Dollar amounts in millions)

Source of funds	Total	Public		Private	
		Amount	As percent of total	Amount	As percent of total
Total	$1,272.4	$703.1	55.3	$569.4	44.7
Federal Government	917.3	442.3	48.2	475.1	51.8
State and local governments	173.2	160.7	92.8	12.4	7.2
Foundations and voluntary health agencies	61.4	23.6	38.4	37.8	61.6
Industry	40.4	25.2	62.4	15.2	37.6
Institutions' own funds	58.9	38.9	66.0	20.0	34.0
Other sources	21.3	12.4	58.2	8.9	41.8

In addition, the Federal Government has sought to use its support of scientific activities to strengthen the universities themselves. To this end, it has been the Government's policy to provide research funds to academic institutions under conditions that encourage improvement and extension of their programs for research and science education and to extend grants and contracts to institutions not previously engaged in Federal research programs in order to broaden the base of academic science.

The main source of Federal funds for separately budgeted research and development was the Department of Health, Education, and Welfare (HEW), with 44 percent in 1964 (table 5). The HEW support stems primarily from the medical and health-related programs of the National Institutes of Health (NIH). The research performed in the medical and biological sciences by the universities and colleges for NIH represented its largest obligations to any extramural performer.[12]

The next largest Federal supporters were the Department of Defense (DOD) and the National Science Foundation (NSF). DOD funds amounted to 22 percent of the Federal total; NSF funds, 14 percent. In contrast with NIH, the DOD funds supporting separately budgeted research and development in universities and colleges were a very small portion of DOD's extramural R&D obligations, performed largely by industry. However, of DOD's total basic research obligations, almost one-half went to universities and colleges. Universities and colleges performed almost three-fourths of the research (primarily basic) supported by NSF.

Other agencies together accounted for 21 percent of total Federal support for separately budgeted research and development. Those with relatively large amounts included the Atomic Energy Commission (AEC), the U.S. Department of Agriculture, and the National Aeronautics and Space Administration (NASA). The support by AEC and NASA represented a very small portion of these agencies' obligations; although both agencies have extensive extramural R&D programs, very little of the work is performed by universities and colleges. The Department of Agriculture supported primarily the agricultural experiment stations, its main extramural performer. In contrast to the AEC, NASA, and NSF, Agriculture's primary effort is for intramural performance, largely interrelated with the work of the agricultural experiment stations.

Institutions of higher education have traditionally provided research services to private organizations and State and local governments. In 1964, this work amounted to $355 million (or 28 percent of the total separately budgeted R&D expenditures) financed by State and local governments, foundations and voluntary health

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[12] National Science Foundation, *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1964, 1965, and 1966*, Vol. XIV (NSF 65-19). Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1965.

TABLE 5.—*Federally financed current expenditures for separately budgeted research and development in universities and colleges, by Federal agency, 1964*

(Millions of dollars)

Federal agency	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Total	$917.3	$907.3	$10.0	$284.0	$71.0
Atomic Energy Commission	68.6	68.3	.4	4.2	3.1
Department of Agriculture	51.3	51.3	—	.1	47.7
Department of Defense	198.1	195.0	3.1	13.2	.9
Department of Health, Education, and Welfare	401.1	398.7	2.4	254.0	11.2
National Aeronautics and Space Administration	43.6	43.2	.4	2.6	.2
National Science Foundation	126.2	123.1	3.1	7.4	3.9
Other agencies	28.4	27.7	.7	2.6	4.2

[a] Includes medical schools and agricultural experiment stations.

agencies, industry, institutions' own funds, and other non-Federal sources. Of this group, the principal source was State and local governments, with $173 million or 49 percent. Most of this support, $117 million, went to schools of agriculture and their affiliated agricultural experiment stations (appendix table A–3), reflecting to a large extent the importance of these institutions to the State economy.[13] In addition, universities and colleges in most States play very important roles in solving State and regional research problems related to transportation, mental health, labor relations, economic development, and highway design.

An additional 34 percent of the non-Federal total came from foundations and voluntary health agencies and from institutions' own funds, amounting to $61 million and $59 million respectively. The remaining 17 percent of total non-Federal expenditures came from industry and other sources. It should be noted that "source of funds," as defined here, refers to immediate sources rather than ultimate sources of funds concerned. For example, a foundation was identified as the source of support if it financed research through a restricted gift or grant even though an industrial concern may have been the source of all or part of the foundation's funds.

Character of Work

R&D activities of universities and colleges are heavily oriented toward basic research, which in 1964 amounted to 79 percent of the total for current expenditures for separately budgeted research and development. Applied research accounted for 18 percent of the total; development, 3 percent. Medical schools and agricultural experiment stations together accounted for 57 percent of the expenditures for applied research and 47 percent of the expenditures for development (appendix table A–3).

Field of Science

Life sciences accounted for more than one-half of the $1.2 billion spent for separately budgeted research (basic and applied) with medical sciences alone accounting for 26 percent; biological sciences, 15 percent; and agricultural sciences, 13 percent. (See appendix table A–4.) The large share of research expenditures in the life sciences results mainly from the predominance of such research in medical schools and agricultural experiment stations, which together accounted for 79 percent of the total for life sciences in universities and colleges. Medical schools accounted for 85 percent of the research expenditures in the medical sciences; agricultural experiment stations accounted for 91 percent of research in the agricultural sciences. And together these institutional components accounted for 56 percent of research in the biological sciences. Ranking next in terms of research expenditures were the physical sciences, 24 percent; engineering, 13 percent; social sciences, 6 percent; and psychological sciences, 3 percent.

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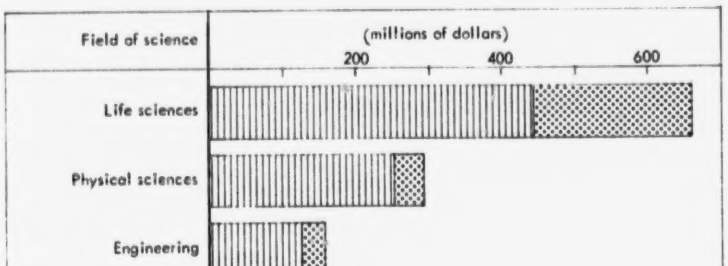
[13] Section 7 presents summary data on the scientific activities of agricultural experiment stations.

Nearly one-half of the Federal support was spent in the life sciences, including 28 percent for the medical sciences. An additional 28 percent was channeled into the physical sciences and 14 percent into engineering. (See chart 3.) The social sciences, psychology, and other sciences together accounted for 8 percent of the Federal funds.

A larger proportion of non-Federal funds (64 percent) than Federal funds was designated for the life sciences; and, within the life sciences, 33 percent was spent for agricultural sciences and only 19 percent for the medical sciences. These differences are largely attributable to heavy Federal support of medical and health-related sciences and the allocation of a large proportion of State support for the agricultural sciences in agricultural experiment stations (appendix table A–4).

The Federal share, although not the amount, of current expenditures for separately budgeted research was largest in the physical sciences and in psychology, with 86 percent of each, followed by engineering and medical sciences, 80 percent each; life sciences, 67 percent; and social sciences, 52 percent (appendix table A–4).

Chart 3. Current expenditures for separately budgeted research in universities and colleges, by broad field of science and source of funds, 1964



Source: National Science Foundation (appendix table A–4).

Geographic Distribution

Although R&D activities are conducted in universities and colleges throughout the country, institutions with large graduate-degree programs in the sciences and engineering account for the preponderant share. These institutions are not evenly distributed among geographic areas, and neither are the dollar amounts of R&D performance. Institutions located in the Middle Atlantic division expended 20 percent of the $1.3 billion total separately budgeted R&D expenditures; in the East North Central and Pacific divisions, 18 percent and 15 percent respectively. These three divisions together (of the nine divisions and U.S. territories) accounted for more than one-half of the 1964 total separately budgeted R&D expenditures and also for more than one-half of the Federal portion of that total (table 6).

Among individual States, funds for separately budgeted research and development in universities and colleges ranged from $150 million in New York to less than $3 million in the States of Maine, Nevada, Vermont, and Delaware. Universities and colleges located in 10 States accounted for 59 percent of the separately budgeted total and for 63 percent of the Federal part of that total (appendix table A–5).

In each of the geographic divisions, the Federal Government financed three-fifths or more of the separately budgeted research and development (chart 4). The federally financed portions were highest in the Middle Atlantic, New England, and East North Central divisions. Relative amounts from non-Federal sources tended to be highest in divisions where agricultural experiment stations account for a sizable share of the R&D activities—such as more than one-third in the West North Central, West South Central, and East South Central divisions. As noted earlier, State governments financed the major share—56 percent of the R&D activities of such stations. (See appendix table A–3.)

TABLE 6.—*Percent distribution of current expenditures for separately budgeted research and development in universities and colleges, by geographic location and source of funds, 1964*

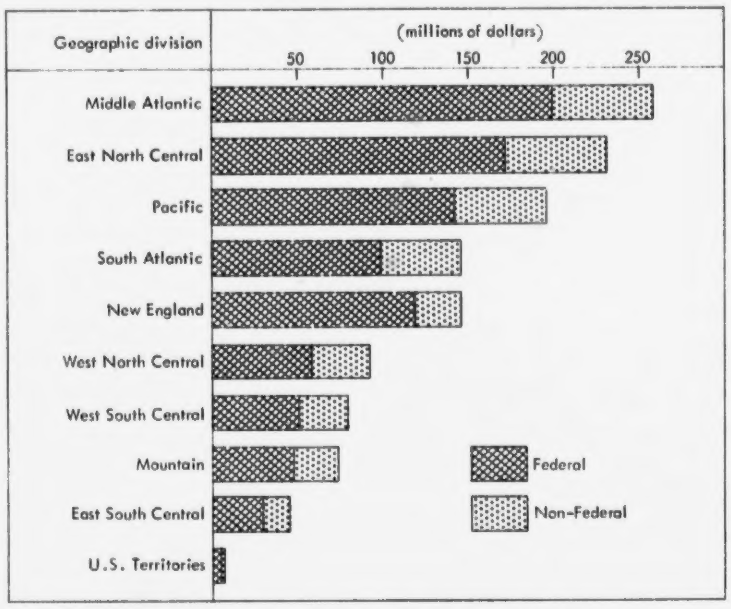
Geographic region and division	All sources	Federal Government	Non-Federal
	Millions of dollars		
United States, total	$1,272.4	$917.3	$355.1
	Percent of total amount		
Northeast	31.7	34.6	24.2
New England	11.5	12.9	7.7
Middle Atlantic	20.2	21.6	16.5
North Central	25.4	25.1	26.1
East North Central	18.1	18.8	16.4
West North Central	7.2	6.3	9.6
South	21.3	19.4	26.2
South Atlantic	11.5	10.8	13.2
East South Central	3.5	3.1	4.6
West South Central	6.2	5.4	8.3
West	21.2	20.6	22.9
Mountain	5.8	5.1	7.5
Pacific	15.4	15.5	15.4
U.S. territories	.5	.4	.6

Source: Appendix table A-5.

In another aspect of geographic distribution–expenditures for separately budgeted research by broad field of science—the life sciences were highest in every division (appendix table A-6). However, institutions in New England, for example, showed a strong interest in the physical sciences and engineering, with 30 percent and 16 percent respectively, and 40 percent in the life sciences. In contrast, East South Central institutions allocated 80 percent of their research expenditures for the life sciences and only 13 percent for engineering and the physical sciences together.

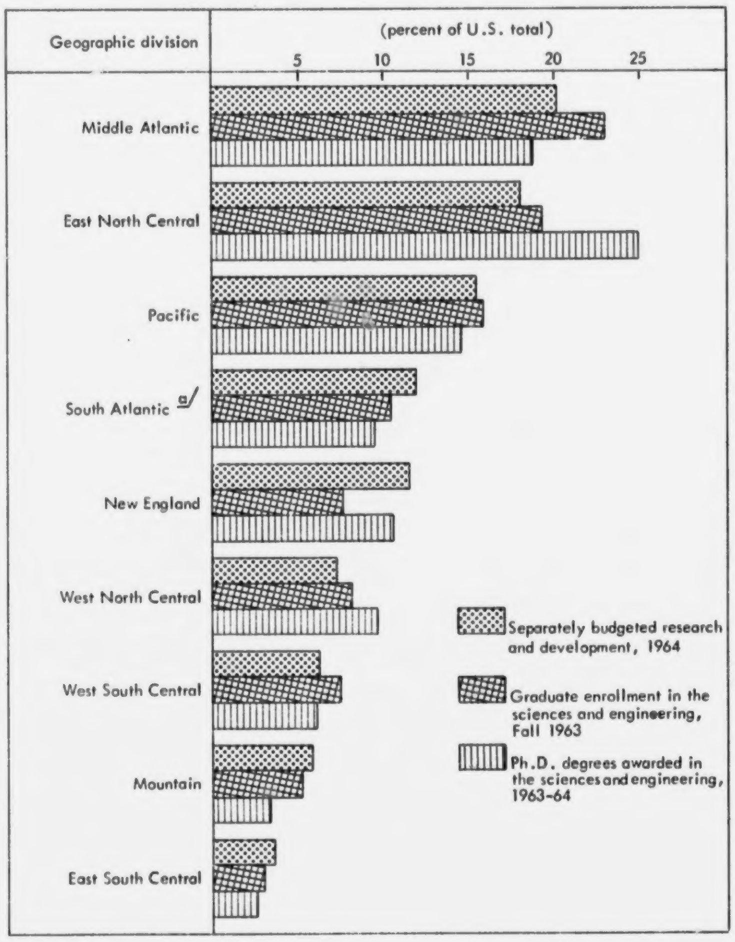
The distribution of R&D expenditures by geographic division nearly parallels the distribution of certain educational variables, such as doctorate degrees awarded and graduate enrollments in the sciences and engineering. Thus, the three geographic divisions that ranked highest in separately budgeted R&D expenditures also ranked highest in the doctorate de-

Chart 4. Current expenditures for separately budgeted research and development in universities and colleges, by geographic division and source of funds, 1964



Source: National Science Foundation (appendix table A-5).

Chart 5. Comparison of current expenditures for separately budgeted research and development in universities and colleges with graduate enrollments and Ph.D. degrees awarded, by geographic division, 1964



[a] Includes Puerto Rico.

Sources: National Science Foundation and U.S. Office of Education.

grees and graduate enrollments, accounting for more than one-half of each. Similarly, the three divisions that ranked lowest in these expenditures also ranked lowest in the science and engineering doctorates awarded and in graduate enrollments (chart 5).

Principal Cost Items

Current expenditures for separately budgeted research and development include direct costs and reimbursed or reimbursable indirect costs of R&D performance financed through gifts, grants, or contracts. They do not include expenditures of institutions' own funds used to defray indirect costs incurred on R&D projects financed by outside sponsors.[14]

Direct costs for salaries and wages, the major cost item, averaged 53 percent of total current expenditures in 1964. Other direct costs, including materials and expendable equipment, amounted to 36 percent, and reimbursed or reimbursable indirect costs represented 11 percent.

As might be expected, the cost breakdown of institutions granting graduate degrees in the sciences and engineering, as performers of 99 percent of the separately budgeted research and development, coincided with the overall average. (See appendix table A–7.) The pattern for medical school expenditures varied little from the overall pattern. But agricultural experiment stations and related colleges of agriculture were higher in direct salaries and wages, with 70 percent; lower in other direct costs, with 28 percent, and in reimbursed indirect costs, with 2 percent.

Section 2. Current Expenditures for Instruction and Departmental Research

Current direct and indirect expenditures for instruction and departmental research amounted to an estimated $2.1 billion in 1964 (table 7). This total includes all direct and indirect costs for instructional programs in the sciences and engineering for students pursuing degree-credit courses of study. It does not include the estimates for unreimbursed indirect costs of sponsored research and development that were included in earlier discussions of separately budgeted R&D activities.

Among the various types of direct costs, totaling $1.6 billion in 1964, were salaries of department heads, faculty members, secretaries, and technicians; costs of materials and equipment; and other expenses associated with the administration of a department. These direct expenditures for instruction and departmental research represented 57 percent of the direct expenditures for instruction and departmental research in all fields of degree-credit instruction in the U.S. institutions of higher education, which, according to the U.S. Office of Education, totaled $2.8 billion in 1964.[15]

Indirect or overhead expenditures associated with instruction and departmental research activities carried out in science and engineering departments amounted to an estimated $501 million (24 percent of the total). Such expenditures include the share of institutional expenditures for general administration, student services, and libraries and for the operation and maintenance of physical plant. The indirect cost rates were lower for institutions granting graduate degrees than for 4-year colleges or junior colleges. Moreover, the rates reported for medical schools and agricultural experiment stations were lower than for other components of institutions (table 7). One explanation may be that these components are often housed in separate facilities, sometimes at a considerable distance from the main campus; thus expenditures for electricity, water, etc., which would normally be classified as indirect costs, may be counted as direct costs for these installations.

Because institutions traditionally keep records of current expenditures for instruction and departmental research on a direct cost basis, the 1964 survey requested the current direct expenditures for the various fields of science. Data relating to geographic distribution and type of control also were tabulated

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[14] See Definitions and appendix C. Such unreimbursed expenditures were estimated to total $103.4 million in 1964, as shown in table 1.

[15] Department of Health, Education, and Welfare, Office of Education, *Digest of Educational Statistics, 1966*, OE–10024–67. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1966, p. 93.

Table 7.—*Current expenditures for instruction and departmental research in the sciences and engineering in universities and colleges, by type of expenditure, 1964*

(Millions of dollars)

Type of expenditure	Total	Institutions granting graduate degrees [a]	Other institutions	Selected components of graduate institutions: Medical schools	Selected components of graduate institutions: Agricultural schools and experiment stations
Total	$2,053.8	$1,676.2	$377.6	$318.6	$77.2
Direct costs	1,553.1	1,275.4	277.7	253.0	63.3
Indirect costs	500.7	400.8	99.9	65.5	13.9

[a] Includes medical schools and agricultural experiment stations.

in these terms. In recent years, a number of institutions have attempted to make compilations for total cost including indirect costs, reflecting more accurately the actual burden in a particular department or college.

Departmental Research

Universities and colleges seldom maintain separate records on the departmental research activities of their faculties but include these activities in the departmental budgets, usually identified as "current expenditures for instruction and departmental research." This joint financing of instruction and departmental research is in accord with the view that teaching and research are closely related within the professional lives of university and college faculty and that faculty members must do research to stay at the forefront of their fields if they seek to be effective in their teaching. Departmental research differs from "separately budgeted research" principally in the financing and administrative procedures associated with the performance of the research, not necessarily in the substance of the research.

Most universities and colleges that perform separately budgeted research and development also allocate resources for departmental research; and departmental research is performed in many institutions that do not perform separately budgeted research and development. In the latter situation the institutional contribution sometimes is small, such as permitting the faculty members to use facilities and equipment for research "on their own time."

Some examples of expenditures (or costs) associated with the performance of departmental research follow: (1) Reduction in teaching load or administrative duties for faculty members engaged in departmental research; (2) salary attributable to research projects or grants for faculty members serving as principal investigators but paid from departmental funds rather than by project sponsors; (3) compensation to eminent scholars appointed as visiting professors, who may give some graduate seminars but primarily carry out research projects of their choice; (4) costs for exploratory research undertaken to formulate research project proposals that may or may not subsequently receive support and cost reimbursement; and (5) library, secretarial assistance, materials, equipment, and other expenses incurred by a department and attributable to faculty research projects, including research performed on the investigators' own time.

Characteristics of Institutions

The institutions that granted graduate degrees in the sciences and engineering in 1964 accounted for 82 percent of the current expenditures for instruction and departmental research in those fields. (See appendix table A–8.) This proportion for graduate institutions was somewhat lower than that reported in current expenditures for separately budgeted research and development (99 percent) and in capital expenditures for research, development, and graduate instruction (97 percent). Of the institutions not offering graduate degrees in the sciences and engineering, a substantial number reported no separately budgeted research and development or capital expenditures for research and development.

Publicly controlled institutions accounted for 62 percent of the direct expenditures for instruction and departmental research in 1964. This proportion was the same as the public institutions' share of fall 1963 opening enrollments of students working toward a bachelor's or graduate degree.

Field of Science

The life sciences accounted for the largest proportion, 37 percent, of the $1.6 billion in direct expenditures for instruction and departmental research, followed by the physical sciences, 23 percent; social sciences, 18 percent; and engineering, 14 percent. Psychology and other sciences combined accounted for a little over 8 percent.

For the institutions granting graduate degrees in the sciences and engineering, their largest shares of the expenditures for instruction and departmental research were in the life sciences (90 percent) and in engineering (86 percent). (See appendix table A–9.) Medical schools and agricultural experiment stations together accounted for 54 percent of the expenditures in the life sciences.

Geographic Distribution

The Middle Atlantic and East North Central divisions together accounted for 38 percent of the current direct expenditures for instruction and departmental research in the sciences and engineering in 1964. (See appendix table A–10.) These divisions also accounted for similar proportions of current separately budgeted R&D expenditures and of capital expenditures for research, development, and instruction. The Pacific division, with 13 percent of the instruction and departmental research expenditures, was somewhat lower than in other scientific activities covered in the survey. The South Atlantic division, with 12 percent, was somewhat higher than in the other activities, reflecting in part the relative importance of undergraduate instruction in that geographic division. The percent of total expenditures for instruction and departmental research in each division was as follows:

Total	100
East North Central	20
Middle Atlantic	18
Pacific	13
South Atlantic	12
New England	9
West North Central	9
West South Central	8
Mountain	6
East South Central	5
U.S. territories	1

Section 3. Capital Expenditures for Scientific and Engineering Facilities and Equipment

The rapid expansion of R&D activities and increases in enrollments for science education have necessitated corresponding increases in costly equipment and facilities.

Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction at universities and colleges totaled $530 million in 1964 (table 8). As defined in the survey, capital expenditures refer to funds actually disbursed for facilities that were in process or that were completed during 1964. Included in the definition of capital expenditures were fixed (built-in) equipment, movable scientific apparatus, movable furnishings, architects' fees and site work, and special facilities to house scientific apparatus.[16] Outside the scope of the survey were facilities not used principally for research, development, and instruction in the sciences and engineering, such as administrative buildings, heating plants and other utilities, and residence halls.

Assembling data on capital expenditures for scientific and engineering facilities during 1964 presented some reporting problems for respond-

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[16] See questionnaire instructions in appendix C for specific examples of capital expenditures for science and engineering covered by the 1964 survey.

TABLE 8.—*Capital expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by source of funds and purpose, 1964*

(Millions of dollars)

Source of funds and purpose	Total	Institutions granting graduate degrees [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
All sources	$529.5	$450.6	$78.9	$105.6	$29.4
Research, development, and graduate instruction	289.0	281.6	7.4	88.1	20.8
Undergraduate instruction	240.5	169.0	71.5	17.5	8.6
Federal Government	134.4	128.5	5.9	48.5	7.3
Research, development, and graduate instruction	108.1	106.9	1.2	41.4	6.1
Undergraduate instruction	26.3	21.6	4.7	7.1	1.2
Non-Federal	395.1	322.0	73.0	57.1	22.0
Research, development, and graduate instruction	180.9	174.7	6.2	46.7	14.7
Undergraduate instruction	214.2	147.4	66.8	10.4	7.4

[a] Includes medical schools and agricultural experiment stations.

ents. In addition, providing information on various characteristics of such expenditures, such as source of financing, field of science, and purpose, involved an even greater degree of difficulty. For example, multipurpose facilities are frequently used for both undergraduate and graduate instruction and for research in several different scientific disciplines. Similarly, funds from various sources, both Federal and non-Federal, may have been used to finance a building or other facility. In reporting data on multipurpose facilities, respondents were asked to prorate expenditures according to anticipated uses of space or facilities.

Source of Funds

Universities and colleges traditionally have relied on their own resources for the financing of facilities and equipment for science and engineering. Non-Federal sources, including State and local government appropriations, endowments, and other private allocations, supplied three-fourths of the total funds expended for science and engineering facilities and equipment (table 8). These sources financed 71 percent of the capital expenditures for science and engineering made by the institutions granting graduate degrees in these fields and 93 percent of those made by undergraduate institutions with programs in the sciences and engineering. Medical schools received 54 percent of their total capital funds for the sciences and engineering from non-Federal sources; agricultural experiment stations, 75 percent. (See appendix table A–11.)

The primary Federal source of capital expenditures for research, development, and instruction in the sciences and engineering was the Department of Health, Education, and Welfare (HEW), which financed 54 percent of the Federal total. Of this support by HEW, 63 percent went to medical schools, reflecting the programs of the Public Health Service. (See appendix table A–12.) The National Science Foundation supplied the second largest amount of Federal funds for capital expenditures—30 percent of the total. All other Federal agencies together accounted for only 17 percent.

Purpose

Capital expenditures for research, development, and instruction were placed in two categories in regard to purpose: (1) research, development, and graduate instruction and (2) undergraduate instruction. Institutions that used a facility for both categories in 1964 were asked to prorate their capital expenditures accordingly. It was estimated that 55 percent of these capital expenditures were for research, development, and graduate instruction; 45 percent, for undergraduate instruction. (See table 8.)

Of the $395 million from non-Federal sources (three-fourths of the total capital expenditures for science and engineering in universities and colleges in 1964), $214 million supported capital expenditures for undergraduate instruction in the sciences and engineering; $181 million, for research, development, and graduate instruction. Of the $134 million capital expenditures financed by the Federal Government, $108 million or 80 percent were for research, development, and graduate instruction in the sciences and engineering.

Field of Science

Capital expenditures for research, development, and instruction (like current expenditures) were largest in the life sciences (44 percent), followed by the physical sciences (29 percent), engineering (14 percent), and social sciences (6 percent). Other sciences, including psychology, accounted for 7 percent of the capital expenditures in 1964. (See appendix table A–13.)

Of the Federal Government total for these purposes, 61 percent was in the life sciences, but only 25 percent in the physical sciences. The difference was smaller for the non-Federal sector, with 38 percent for the life sciences and 30 percent for the physical sciences. (See appendix table A–13.)

The life sciences also accounted for the largest single share of capital funds at the graduate level (research, development, and graduate instruction) from all sources, with 55 percent, reflecting the strong Federal support. The physical sciences again were second, with 26 percent. For undergraduate instruction, the two fields were reversed, with 33 percent for the physical sciences and 30 percent for the life sciences.

Geographic Distribution

Three geographic divisions—the East North Central, Middle Atlantic, and Pacific—together accounted for 61 percent of total capital expenditures, with nearly identical shares (about 20 percent each). (See table 9.) The relatively heavy concentration of scientific activities was noted earlier for separately budgeted R&D expenditures, with these three divisions accounting for 54 percent of the nationwide total.

The pattern of capital expenditures according to their purpose shows that New England expended a somewhat higher proportion for research, development, and graduate instruction, but lower for undergraduate instruction. In contrast, East North Central was higher for undergraduate instruction and lower for research, development, and graduate instruction.

The distribution of Federal funds for capital expenditures among divisions follows the general pattern for all sources, except in the New England and Pacific States. The New England division received a greater share of the Federal funds, less of the non-Federal funds; the Pacific division less of Federal funds, more of non-Federal funds. (See table 9.)

TABLE 9.—*Geographic distribution of capital expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by source of funds, 1964*

Geographic region and division	Total	Federal Government	Non-Federal
	Millions of dollars		
United States, total	$529.5	$134.4	$395.1
	Percent of total amount		
Northeast	27.8	28.9	27.4
New England	7.5	9.8	6.7
Middle Atlantic	20.3	19.1	20.7
North Central	28.9	29.2	28.7
East North Central	20.6	21.9	20.1
West North Central	8.3	7.3	8.7
South	19.9	23.2	18.9
South Atlantic	8.3	9.4	7.9
East South Central	5.3	6.0	5.0
West South Central	6.4	7.7	5.9
West	23.3	18.5	24.9
Mountain	3.5	4.1	3.2
Pacific	19.8	14.4	21.6
U.S. territories	.1	.2	.1

Source: Appendix table A–14.

EMPLOYMENT CHARACTERISTICS

Section 4. Scientists and Engineers

Universities and colleges in the United States and its territories employed 250,000 scientists and engineers in January 1965 (table 10). This total encompasses both full-time and part-time personnel working at professional levels in the sciences and engineering, including graduate students employed part time as scientists and engineers in teaching, research and development, and related activities. These professional personnel comprised about 18 percent of approximately 1.4 million scientists and engineers employed in all sectors of the economy.[1] University and college employment of scientists and engineers is slightly higher than that of the Federal Government, but far less than the number employed in the industrial sector of the economy.

This section of the report analyzes several of the principal characteristics of professional employment in the sciences and engineering in the Nation's universities and colleges. Employment data are reported in terms of both total number of full- and part-time personnel and their full-time-equivalent numbers.[2] Statistics on scientific and engineering employment are analyzed by principal function (teaching, research and development, and other activities), geographical area, field of science, organizational component, and type of institution. To the extent possible, employment characteristics for January 1965 are compared with those for earlier years.

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[1] Unpublished estimates by the U.S. Department of Labor's Bureau of Labor Statistics and the National Science Foundation.

[2] The full-time-equivalent number of scientists and engineers is defined as the sum of those employed full time and the full-time equivalent of those employed part time. For the survey, the respondent institution was requested to use its own definition of full-time equivalent.

TABLE 10.—*Trends in the employment of scientists and engineers in universities and colleges, by employment status and function, 1958, 1961, and 1965*

Employment status and function	March 1958 [a]	March 1961 [a]	January 1965	Compound annual rate of increase, 1958–1965
	Thousands			(Percent)
Number of scientists and engineers in all activities	148.8	175.4	250.0	7.7
Full time	96.2	112.2	148.8	6.4
Part time	22.6	26.9	40.8	8.8
Employed graduate students	30.0	36.3	60.4	10.5
Full-time-equivalent scientists and engineers in all activities	119.5	138.4	192.6	7.1
Teaching	73.0	84.5	117.7	7.1
Research and development	36.5	42.4	54.9	6.0
Other activities	10.0	11.5	19.9	10.4

[a] Estimates based on NSF surveys of universities and colleges conducted in 1958 and 1961.

Trends

From March 1958 to January 1965, the number of scientists and engineers employed by universities and colleges increased from 148,800 to 250,000, or at an annual rate of 8 percent (table 10). Among them, the full-time personnel increased at an annual rate of 6 percent over the 7-year span; part-time personnel, 9 percent; and part-time employed graduate students, more than 10 percent.

In full-time equivalents (FTE), scientists and engineers in universities and colleges rose from 119,500 in 1958 to 192,600 in 1965, or at an annual rate of 7 percent (table 10). This rate of increase was lower than that for the numbers of persons (full time and part time) reported, because the part-time personnel and graduate students employed part time increased more rapidly than the full-time personnel. Among the FTE scientists and engineers, those in teaching increased by an annual rate of 7 percent during 1958–65; in research and development, 6 percent; and in other activities, 10 percent.

Institutions Employing Scientists and Engineers

The concentration of scientific activities in institutions granting graduate degrees in the sciences and engineering, as shown in the expenditure data, is seen also in the employment data (table 11). The 180 institutions granting doctorate degrees in the sciences and engineering employed nearly three-fourths of the 250,000 scientists and engineers in universities and colleges in 1965 (appendix table A–15). In addition, 10 percent were employed by the 220 institutions granting the master's degree as their highest science or engineering degree. The medical schools and the agricultural experiment stations together employed 29 percent of the total.

Publicly controlled institutions employed 61 percent of the total scientists and engineers employed in universities and colleges and 63

TABLE 11.—*Selected characteristics of scientists and engineers employed in universities and colleges, January 1965*

(Thousands)

Selected characteristics	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate schools	
				Medical schools	Agricultural schools and experiment stations
Total	250.0	210.2	39.8	51.1	22.4
Employment status:					
Full time	148.8	118.1	30.6	30.9	15.8
Part time	40.8	31.9	8.9	16.0	1.2
Employed graduate students	60.4	60.2	.2	4.2	5.4
Field of science:					
Engineers	32.4	28.2	4.1	[b]	.7
Physical scientists	62.4	49.6	12.7	.2	.4
Life scientists	100.7	93.6	7.1	50.4	19.0
Psychologists	12.7	9.3	3.4	.3	—
Social scientists	40.7	29.0	11.7	.1	2.0
Other scientists	1.1	.5	.6	—	.3
Institutional control:					
Public	152.9	132.5	20.4	21.9	22.4
Private	97.1	77.8	19.3	29.2	[c]

[a] Includes medical schools and agricultural experiment stations.

[b] Fewer than 0.05 (50).

[c] All agricultural experiment stations are under public control.

percent of those in the institutions granting degrees in the sciences and engineering. Of the total for medical schools, publicly controlled institutions accounted for 43 percent (table 11).

The institutions granting graduate degrees in the sciences and engineering of course employed virtually all of the 60,400 graduate students working part time as scientists and engineers. These institutions also employed 79 percent of the 148,800 full-time scientists and engineers in 1965 and 78 percent of the 40,800 part-time scientists and engineers. Medical schools accounted for 21 percent of the full-time personnel, 39 percent of the part-time personnel, but only 7 percent of the employed graduate students (table 11).

Employment Status

In contrast with other sectors of the economy, a relatively large portion (40 percent) of the scientists and engineers are employed part time in universities and colleges. In January 1965, these included 40,800 part-time scientists and engineers and 60,400 employed graduate students (table 11). The stimulation of this academic work and the opportunity for supplementary income attract many scientists and engineers to part-time work in the universities and colleges from other sectors of the economy, particularly industry and government. For the graduate student, his employment at the university is often closely associated with his assigned studies and is frequently a principal source of financial support.

In terms of full-time equivalents, the 400 institutions granting graduate degrees in the sciences and engineering accounted for 82 percent of the 192,600 FTE scientists and engineers employed in universities and colleges (table 12). These institutions employed 72 percent of the FTE scientists and engineers engaged in teaching, 99 percent of those engaged in research and development, and 96 percent of those engaged in other activities. Medical schools and agricultural experiment stations together accounted for 71 percent of the FTE scientists and engineers engaged in other activities and 43 percent of those engaged in research and development.

Field of Science

Life scientists employed in universities and colleges totaled 100,700 in January 1965, or 40 percent of the total for all fields. The predominance of life scientists conformed to the general pattern observed earlier in current and capital expenditures for research, development, and instruction in the sciences and engineering. Next in numbers were the physical scientists, with 25 percent of the total (chart 6).

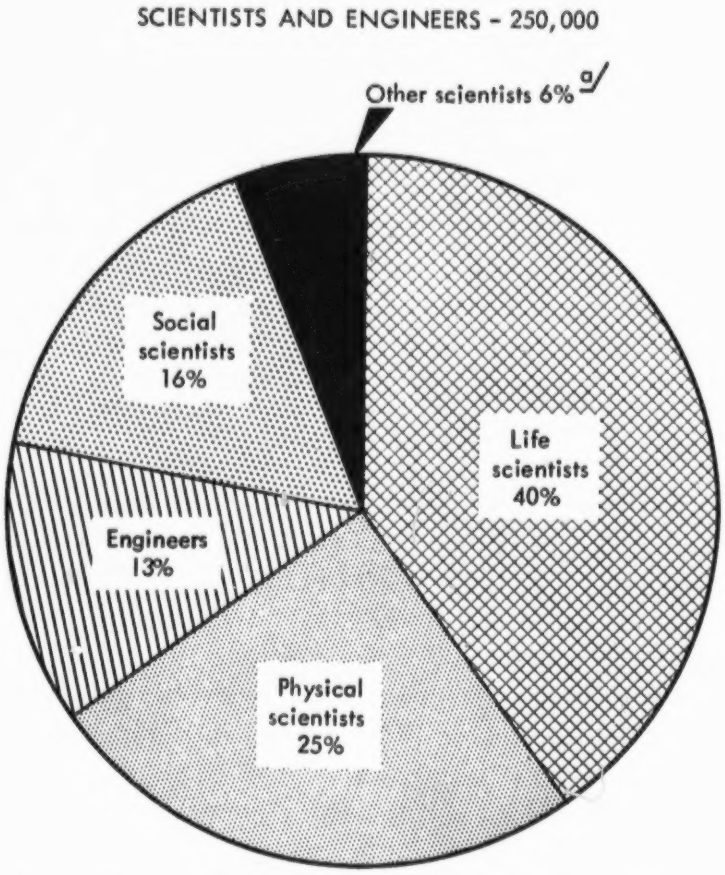
The distribution of full-time scientists and engineers by field of science conformed quite closely to the overall employment pattern (appendix table A-16), but those of part-time scientists and engineers and of employed graduate students differed somewhat. For example, part-time scientists and engineers were as follows: life scientists, 54 percent; physical and

TABLE 12.—*Percent distribution of full-time-equivalent number of scientists and engineers in universities and colleges, by function, January 1965*

Function	Number (thousands)	Percent distribution				
		Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
					Medical schools	Agricultural schools and experiment stations
Total	192.6	100.0	82.3	17.7	19.8	9.9
Teaching	117.7	100.0	72.3	27.8	13.7	3.0
Research and development	54.9	100.0	98.9	1.1	25.7	17.1
Other activities	19.9	100.0	96.0	4.5	40.2	30.7

[a] Includes medical schools and agricultural experiment stations.

Chart 6. Distribution of scientists and engineers employed in universities and colleges, by field, January 1965



Source: National Science Foundation (appendix table A-16).

social scientists, 15 percent each; engineers, 10 percent; and psychologists, 6 percent. In comparison, of the graduate students employed as scientists and engineers, only 26 percent were employed as life scientists, but 38 percent were employed as physical scientists and 17 percent as engineers.

Details of employment status and function for the fields that follow are shown in appendix table A-16.

Life scientists. Most of the life scientists (69 percent) were employed in the 89 medical schools and their hospitals and clinics and in schools of agriculture and the 59 agricultural experiment stations (table 11). Of the total, 62 percent were employed full time, 22 percent were part-time employees, and 16 percent were graduate students.

About one-half of the life scientists were primarily engaged in teaching, and more than one-third were in research and development. The remaining one-sixth were primarily engaged in other activities, a higher proportion than in other broad fields of science. This can be largely attributed to the many doctors in the medical schools who are on the staffs of hospitals and spend most of their time in clinical practice. In the agricultural experiment stations, many of those engaged primarily in other activities are involved in agricultural extension work.

Physical scientists. Physical scientists—including chemists, earth scientists, physicists, and mathematicians—accounted for one-fourth of the scientists and engineers employed in universities and colleges. More than one-half (54 percent) were full-time scientists, one-tenth were part-time, and more than one-third were graduate students working part time (36 percent). Most of the physical scientists (almost three-fourths) were engaged in teaching, and about one-fourth were primarily engaged in R&D activities.

Among the physical sciences, the greatest number of scientists were in chemistry, largely because of the relatively high number of graduate students employed part time. The ratio of chemists in teaching to those in research was a little more than two to one.

Although there were fewer mathematicians than chemists in total, 26 percent more mathematicians than chemists were teaching. But in research, there were three times as many chemists as there were mathematicians.

Earth scientists constituted the smallest group in the physical sciences that were separately identified for this survey.

Social scientists. The third largest group among scientists and engineers was the social scientists, 16 percent of the total. Out of 40,700 social scientists, more than four-fifths were primarily engaged in teaching, and about one-eighth were in research and development.

Among the separately identified social science fields, none varied more than 3 percentage points from the overall proportions of 65 percent full-time personnel, 15 percent part time, and 20 percent employed graduate students.

Engineers. The employment of engineers totaled 32,400, slightly more than one-eighth of all scientists and engineers employed in universities and colleges. Of these engineers, 56 percent were employed full time, 12 percent were part time, and the remaining 32 percent were graduate students employed part time as engineers.

Of all engineers, more than three-fifths were primarily engaged in teaching, one-third in research and development, and the remainder in other activities.

Psychologists. Psychologists, both clinical and social, accounted for about 5 percent of the total number of scientists and engineers in universities and colleges. More than one-half of them were full-time personnel. About three-fourths were primarily engaged in teaching. Most were teaching in the colleges or divisions of arts and sciences; many of those engaged in research were associated with special research units of universities.

Other scientists. Some respondent institutions were unable to classify some of their scientific personnel, usually those involved in interdisciplinary fields of study, under any of the five traditional broad fields of science. The 1,100 scientists in this "other" category accounted for less than one-half of 1 percent of the total number of scientists employed in universities and colleges in January 1965.

Geographic Distribution

The geographic distribution of scientists and engineers employed in universities and colleges exhibits a pattern similar to that already shown for the current and capital expenditures for scientific and engineering activities. That graduate institutions, which in January 1965 employed 84 percent of the scientists and engineers in universities and colleges, are located mainly in large population centers contributes to the concentration of scientists and engineers there.

The agricultural experiment stations, however, and to a lesser extent the medical schools, partially offset this tendency toward geographical concentration. For example, at least one agricultural experiment station is located in each State, and the relative importance of a station's science activities depends largely on the importance of agriculture within the overall economy of the State. Thus, agricultural experiment stations accounted for 15 percent or more of the total scientists and engineers in the West North Central, East South Central, Mountain, and West South Central divisions, compared with only 5 percent in New England and 2 percent in the Middle Atlantic division. (See appendix table A–17.) Similarly, medical schools accounted for relatively high proportions of employed scientists and engineers in the territories (40 percent), the Middle Atlantic division (30 percent), and the South Atlantic division (25 percent).

In the overall pattern, the Middle Atlantic and East North Central divisions each accounted for nearly one-fifth of the scientists and engineers employed in universities and colleges. Within the continental United States, the fewest were in the East South Central and Mountain divisions, each accounting for less than 5 percent of the scientists and engineers. The territories accounted for less than 1 percent.

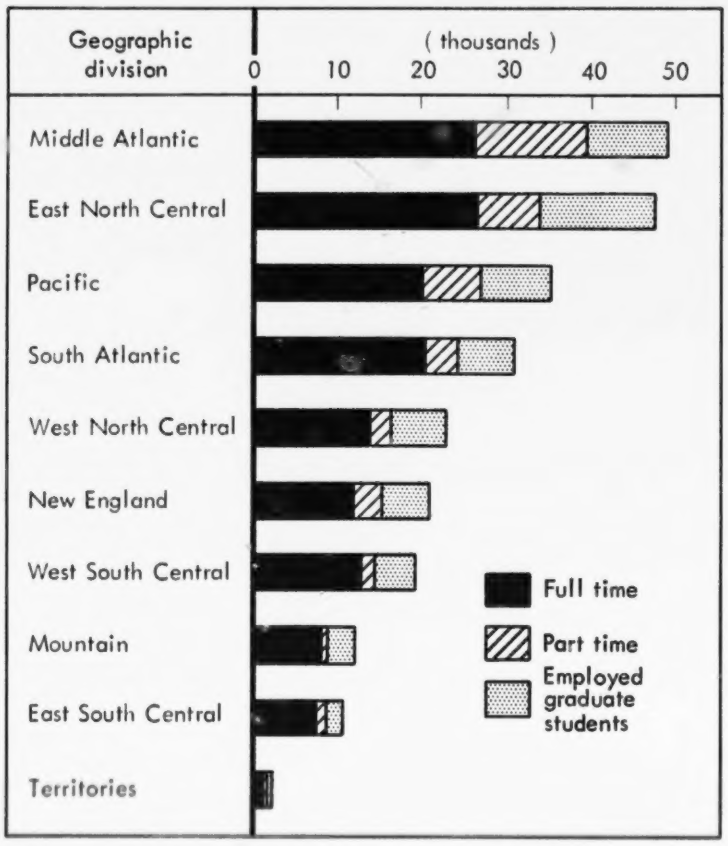
The Middle Atlantic division—the three highly urbanized States of New York, New Jersey, and Pennsylvania—accounted for almost one-third of the part-time scientists and engineers employed in universities and colleges. The five East North Central States employed the largest proportion of graduate students, more than one-fifth of the U.S. total.

The territories had the highest proportion of their scientists and engineers employed full time (73 percent) but were closely followed by the East South Central division, with 71 percent. Full-time personnel comprised 66 percent of the scientific and engineering manpower in the West South Central, Mountain, and South Atlantic divisions. The Middle Atlantic division had the lowest percentage of full-time scientists and engineers (53 percent).

Together, the Middle Atlantic and Pacific divisions accounted for almost one-half of the part-time scientists and engineers employed in universities and colleges—27 percent in the Middle Atlantic and 20 percent in the Pacific. The Mountain division had the lowest percentage of part-time scientists and engineers—6 percent. (See chart 7.)

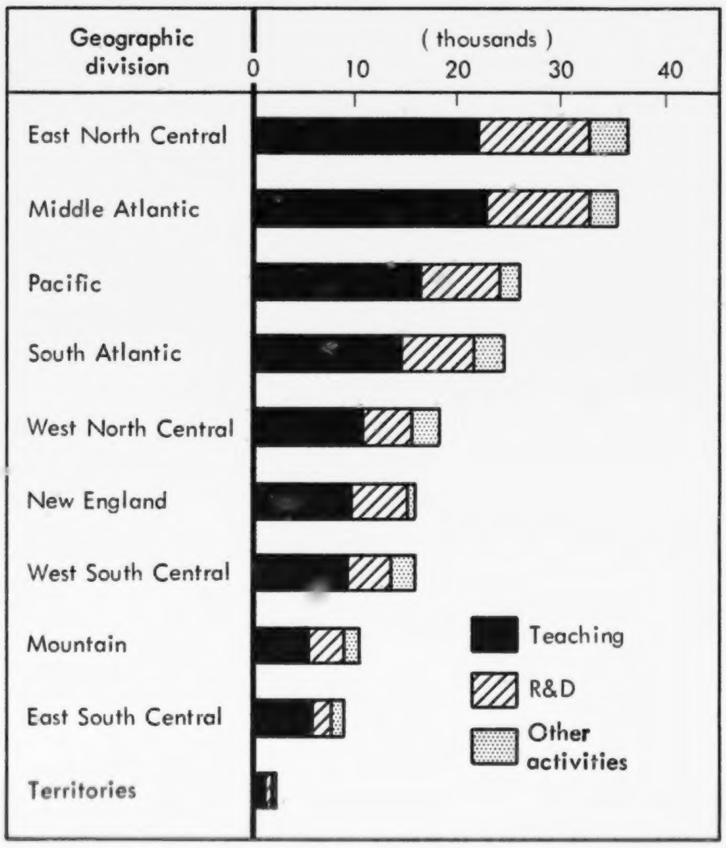
Graduate students employed part time as scientists and engineers accounted for 29 percent of all scientists and engineers in both the East North Central and the West North Central divisions. At the other end of the scale, graduate students made up only 20 percent of employed scientists and engineers in the territories and 18 percent in the East South Central division. Appendix table A–19 shows the

Chart 7. Scientists and engineers employed in universities and colleges, by geographic division and employment status, January 1965



Source: National Science Foundation (appendix table A-18).

Chart 8. Full-time-equivalent number of scientists and engineers employed in universities and colleges, by geographic division and function, January 1965



Source: National Science Foundation (appendix table A-20).

distribution of scientists and engineers, by State and broad field of science, January 1965.

In full-time-equivalent numbers the geographic divisions rank nearly the same as for the total count of scientists and engineers in universities and colleges. The only difference is that the Middle Atlantic and East North Central divisions exchange positions, with the latter employing the largest full-time-equivalent number of scientists and engineers in universities and colleges (chart 8).

By function, the distribution of the full-time-equivalent numbers of scientists and engineers employed in each division varied considerably. In every division those engaged in teaching accounted for at least 54 percent, and as high as 67 percent in the East South Central division. Those engaged in research and development ranged from 20 percent in the East South Central division to 35 percent in New England and 38 percent in the territories; in other activities, 4 percent in New England to 16 percent in the West South Central division (appendix table A-20).

Section 5. Technicians in Institutions Granting Graduate Degrees

Information on the number of technicians primarily employed in the sciences and engineering was obtained in the survey from 636 universities and colleges with graduate programs, including the 400 that awarded graduate degrees in the sciences and engineering. The 1,336 liberal arts colleges, junior colleges, and specialized institutions without graduate programs were not asked for this information because the reporting burden on respondent institutions, particularly those employing relatively few scientific and engineering personnel, was thought to be too much for the expected return.

For the survey, technicians were defined as personnel employed in positions involving technical work at a level requiring knowledge of engineering, mathematics, physical sciences, life sciences, or social sciences acquired through formal post-high school training at technical institutes and junior colleges or through equivalent on-the-job training or experience. Typical job titles in the technician category are laboratory assistant, physical science aide, engineering aide, statistical aide, draftsman, and computer programmer. Excluded from the definition of technician were craftsmen, such as electricians, carpenters, and machinists.

Number Employed

Universities and colleges that grant graduate degrees employed 38,300 technicians in January 1965 (table 13). Virtually all of these technicians (99 percent) were employed in institutions granting graduate degrees in the sciences and engineering. As with science and engineering expenditures and professional employment, medical schools and agricultural experiment stations accounted for a high proportion of technician employment. These two organizational components employed 22,000 technicians, or 57 percent of the total in all graduate institutions. Data on the number of technicians employed in institutions that do not grant graduate degrees are not available, but the number is believed to be quite small.[3]

About two-thirds of the technicians were employed in the life sciences (table 14). This predominance of the life sciences is largely accountable to the relatively large number of technicians employed in medical schools and agricultural experiment stations. (See appendix table A–21.)

Of the 38,300 technicians employed in graduate-degree-granting institutions, 27,600 (72 percent) were employed primarily in R&D activities (table 14). In each of the separately identified scientific disciplines, R&D activities predominated, with more than three-fourths of the technicians employed in the social sciences

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[3] From survey data relating to other types of institutions it was estimated that institutions that do not grant graduate degrees employed about 1,000 technicians in January 1965.

TABLE 13.—*Number of technicians per 100 full-time-equivalent scientists and engineers in universities and colleges granting graduate degrees, by type of activity, January 1965*

Occupational group and type of activity	Institutions granting graduate degrees in—				
	Total	The sciences and engineering	Other	Medical schools	Agricultural schools and experiment stations
Technicians (thousands):					
All activities	38.3	37.9	0.5	18.2	3.8
R&D	27.6	27.4	.2	12.9	3.1
Other	10.7	10.5	.3	5.3	.7
FTE scientists and engineers (thousands):					
All activities	166.3	158.5	7.8	38.2	19.0
R&D	54.6	54.3	.3	14.1	9.4
Other	111.7	104.1	7.5	24.1	9.6
Number of technicians per 100 FTE scientists and engineers:					
All activities	23	24	6	48	20
R&D	51	50	67	91	33
Other	10	10	4	22	7

NOTE: Institutions granting only a baccalaureate and those granting no degrees were not asked to supply data.

TABLE 14.—*Number of technicians in universities and colleges granting graduate degrees, by field and function in which primarily employed, January 1965*

(Thousands)

Field of science	Total	R&D	Other activities
Total	38.3	27.6	10.7
Engineering and physical sciences	8.3	6.5	1.8
Life sciences	25.4	18.2	7.1
Social sciences	1.2	.9	.2
Other sciences	3.5	2.0	1.6

and in engineering and the physical sciences. (For details by State, see appendix table A–22.)

Ratio to Scientists and Engineers

Technician employment averaged 23 per 100 full-time-equivalent (FTE) scientists and engineers in universities and colleges that grant graduate degrees.[4] The ratio was much higher for R&D technicians—51 per 100 FTE R&D scientists and engineers, compared with 10 technicians per 100 FTE scientists and engineers in other activities.

Among organizational components of universities and colleges, the ratio was highest in medical schools, with 48 technicians per 100 FTE scientists, including 91 per 100 FTE scientists in research and development and 22 per 100 FTE scientists in other activities. Agricultural experiment stations had 20 technicians per 100 FTE scientists and engineers, including 33 per 100 in research and development and 7 per 100 in other activities.

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[4] Comparable figures for liberal arts colleges, junior colleges, and specialized institutions without graduate programs are not available, but their technicians were estimated as about 4 per 100 FTE scientists and engineers.

SELECTED COMPONENTS OF GRADUATE INSTITUTIONS

Section 6. Medical Schools

This section presents financial and employment data on the scientific activities of the 89 schools of medicine (approved by the Council on Medical Education and Hospitals and the Association of American Medical Schools) of which 87 were in operation at the time of the start of the survey and two were "developing" medical schools.[1] Of these 89 schools, 85 were 4-year schools of medicine, and 4 were 2-year schools of basic medical science.[2] Included in the data are hospitals or clinics owned, operated, or controlled by universities and integrated operationally with the clinical programs of their medical schools. Also included are research bureaus or institutes that are integral parts of medical schools.

In the past decade, significant changes have taken place in the scope and magnitude of scientific and educational activities carried out in the Nation's medical schools. Population growth, increased personal income, and the spread of health insurance programs are among the factors that have contributed to progressively increasing demands for medical and health research and educational services.

Medical schools perform a variety of interrelated services, such as providing education in the sciences, conducting research, and performing clinical services. Recently, the scope of many medical schools has been broadened to include hospitals and research facilities forming "medical center" complexes for teaching and research in related health fields.

Activities of medical schools are integrated with those of hospitals, research institutes, and parent universities. (In 1964, 41 medical schools owned or operated a total of 47 hospitals, which comprised less than 1 percent of the Nation's 7,138 hospitals.)[3] Many hospital staff members, for example, are also professors in the medical schools, while medical students receive clinical instruction at the hospitals. Teaching responsibilities of medical school staffs include not only the training of undergraduate students but also of residents, interns, and practicing physicians in continuing education programs.

Medical schools in 1964 were evenly divided between public and private control. Throughout the early history of the United States, privately controlled schools provided the greater part of medical education and research. In recent years, however, most of the newly organized medical schools have been affiliated with State universities, a trend that is expected to continue. Of 14 medical schools in the planning stages, 11 are to be State controlled.[4]

Most of the medical schools are subdivisions of larger, multi-purpose universities that provide education in the sciences and perform research and development in all major fields of science; only 10 of the 4-year schools surveyed were independent medical schools. Although historically the universities have provided facilities, funds, scientific knowledge, and administration of the medical schools, now medical schools and other subdivisions of universities and colleges draw faculty and facility support from each other in their respective areas. Technological advances derived from research and development in physics, chemistry, and mathematics, for example, are becoming important factors for the medical sciences.

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[1] University of New Mexico Medical School and South Texas Medical School, University of Texas.

[2] A total of 84 institutions responded completely or in part with usable questionnaires. Data for the remaining five institutions were imputed from secondary sources.

[3] "Hospitals." *Journal of the American Hospital Association*, Vol. 38, pt. 1, Aug. 1964, p. 21.

[4] Including the two "developing" medical schools included in the survey.

Most of the Nation's medical schools are located east of the Mississippi, and three States—New York, Pennsylvania, and Illinois—accounted for 21 of the total 89 medical schools. Of the 36 schools located in the United States west of the Mississippi, six are in California and four are in Texas. During academic year 1963–64, 10 States, of which six are located in the western part of the country, did not have medical schools.[5]

Total enrollment in the 89 medical schools during the academic year 1963-64 was 32,001 with 7,336 M.D. degrees awarded during the year.[6] The 2-year schools of basic medical science grant postgraduate degrees through departments affiliated with the medical schools; however, they do not grant M.D. degrees.

Current Expenditures for Research and Development

Traditionally, medical schools have been much in the forefront of research and development in the sciences in universities and colleges. In 1964, current R&D expenditures of medical schools totaled $438 million, consisting of $351 million for separately budgeted research and development and an estimated $87 million for R&D activities for which the institutions did not maintain separate records. (See table 1.)

Separately budgeted R&D expenditures of medical schools in 1964 were allocated as follows: Basic research, 86 percent; applied research, 13 percent; and development, 1 percent. This compares with 79 percent used for basic research, 18 percent for applied research, and 3 percent for development in all units of universities and colleges. (See appendix table A–3.)

Medical schools received relatively more Federal support for R&D activities than did other organizational components of universities and colleges in 1964. The Federal Government financed 81 percent of the separately budgeted R&D expenditures of medical schools, compared with 72 percent of such expenditures in all units of universities and colleges.

Federal funds to the medical schools ($284 million) were directed mainly toward basic research, with 87 percent for basic research, compared with 12 percent for applied research and 1 percent for development.

The primary source of Federal funds for research and development in medical schools was the Department of Health, Education, and Welfare, with $254 million, or 89 percent of the Federal total allocated to medical schools. The next largest contributor was the Department of Defense, with $13 million, or 5 percent. (See table 5.)

R&D expenditures from non-Federal sources totaled $67 million, or 19 percent of the medical schools' total R&D expenditures. The principal sources of this support were foundations and voluntary health agencies ($30 million) and State and local governments ($12 million), as shown in appendix table A–23.

By type of control, private institutions expended more funds for separately budgeted research and development (59 percent of the total) than public schools did (table 15). The Federal share of each was approximately the same, with 80 percent of the $207 million in R&D expenditures of private medical schools and 82 percent of the $144 million in the public medical schools.

Virtually all research expenditures of medical schools were in the life sciences in 1964. In the medical sciences, research expenditures totaled $269 million, or 85 percent of the amount for medical science research in all units of universities and colleges; in the biological sciences, $76 million, or 42 percent of that total (appendix table A–4).

Medical schools in the Middle Atlantic States ranked highest in separately budgeted R&D expenditures, with $89 million, or 25 percent of the total amount, followed by the East North Central division, with $61 million, or 17 percent. (See chart 9 and appendix table A–23.)

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[5] Includes Rhode Island. Although Brown University's medical program was in operation, it provided only premedical education as of that year; therefore, it was not classified as a medical school for this survey.

[6] "Medical Education in the United States, 1963–64," *Journal of the American Medical Association*, 190:7, Nov. 16, 1964.

TABLE 15.—*Current expenditures for separately budgeted research and development in medical schools, by source of funds and type of control, 1964*

(Dollar amounts in millions)

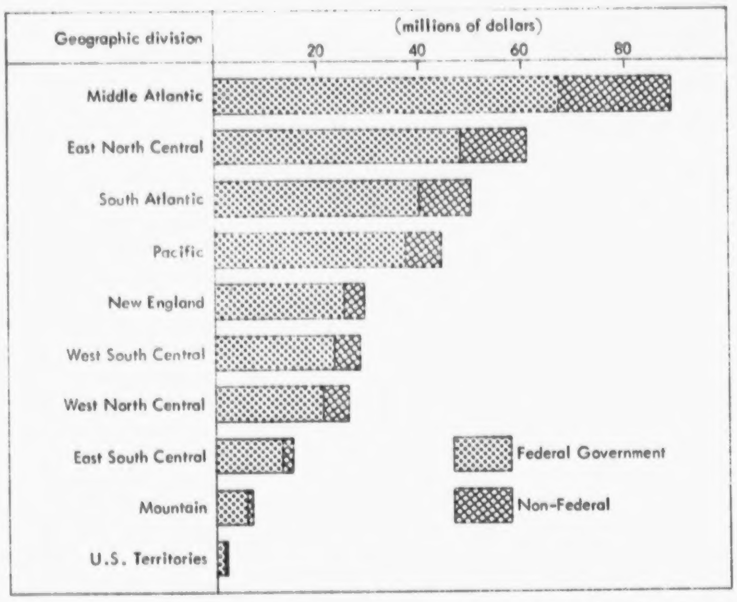
Source of funds	Total	Public		Private	
		Amount	Percent distribution	Amount	Percent distribution
Total	$351.1	$143.6	100	$207.5	100
Federal Government	284.0	118.4	82	165.6	80
State and local governments	11.5	4.1	3	7.4	4
Foundations and voluntary health agencies	29.5	10.1	7	19.4	9
Industry	8.0	3.7	3	4.3	2
Institutions' own funds	9.4	4.0	3	5.5	3
Other sources	8.6	3.3	2	5.3	3

Current Expenditures for Instruction and Departmental Research

The $253 million in direct expenditures of medical schools for instruction and departmental research in the sciences and engineering represented 16 percent of the total for all units of universities and colleges. Indirect costs allocable to these instruction and departmental activities were estimated at $66 million, or 21 percent of the $319 million total (table 7).

Life sciences accounted for virtually all of these expenditures for instruction and departmental research. Less than 1 percent was allocated for these purposes in psychology, the physical sciences, and the social sciences combined (appendix table A–9).

Chart 9. Current expenditures for separately budgeted research and development in medical schools, by geographic division and source of funds, 1964



Source: National Science Foundation (appendix table A–23).

Capital Expenditures for Scientific and Engineering Facilities and Equipment

Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction in medical schools totaled $106 million in 1964. Virtually all of these funds were allocated to the life sciences (appendix table A–11).

In contrast to the current expenditures for separately budgeted research and development, non-Federal sources supplied most of the capital funds, with $57 million, or 54 percent.

Number of Scientists

In January 1965, 51,100 scientists were engaged in teaching, research, and other activities in medical schools.[7] Of this total, 60 percent were employed full time; 31 percent, part time; and 8 percent, graduate students employed part time. (See appendix table A–24.) These graduate students do not include medical students enrolled in programs leading to a first professional degree.

This distribution differed somewhat from that of the rest of universities and colleges,

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[7] In this section of the report the word "engineers" has been dropped from the term "scientists and engineers" used throughout most of this report, because few engineers were employed in medical schools.

where it was 59 percent full time, 12 percent part time, and 28 percent graduate students employed part time. (See table 11.) This difference is mainly the result of the smallness of graduate programs in the total offering of medical schools, and the relatively few graduate students available for employment at such schools. At the same time, the part-time faculty members have been an important segment of the staffs of schools of medicine, particularly in the clinical departments. The medical schools also employed a relatively large number of other professional personnel, engaged mostly as research staff.

The distribution by function differed substantially from that of other organizational units of universities and colleges: 49 percent of the 51,100 scientists in medical schools were primarily teachers, 33 percent were researchers, and 18 percent were engaged in other activities in January 1965. In the rest of universities and colleges, 67 percent were primarily engaged in teaching, 27 percent in research, and 6 percent in other activities. (See appendix table A–24.)

The higher percentage of scientists engaged in research in medical schools than in the rest of universities and colleges can be traced to the flow of research funds to the medical schools and reflects the heavy commitment of medical schools to research in health areas. The relatively high proportion devoted to "other" activities results from the employment in medical schools of scientists in administrative positions, in activities of community service, and in patient care in hospitals or clinics owned or controlled by medical schools.

The scientists in medical schools constituted 20 percent of the scientists and engineers employed in all units of universities and colleges. More specifically, in January 1965 they accounted for 16 percent of the personnel engaged in teaching, 24 percent of those in research, and 42 percent of those in other activities.

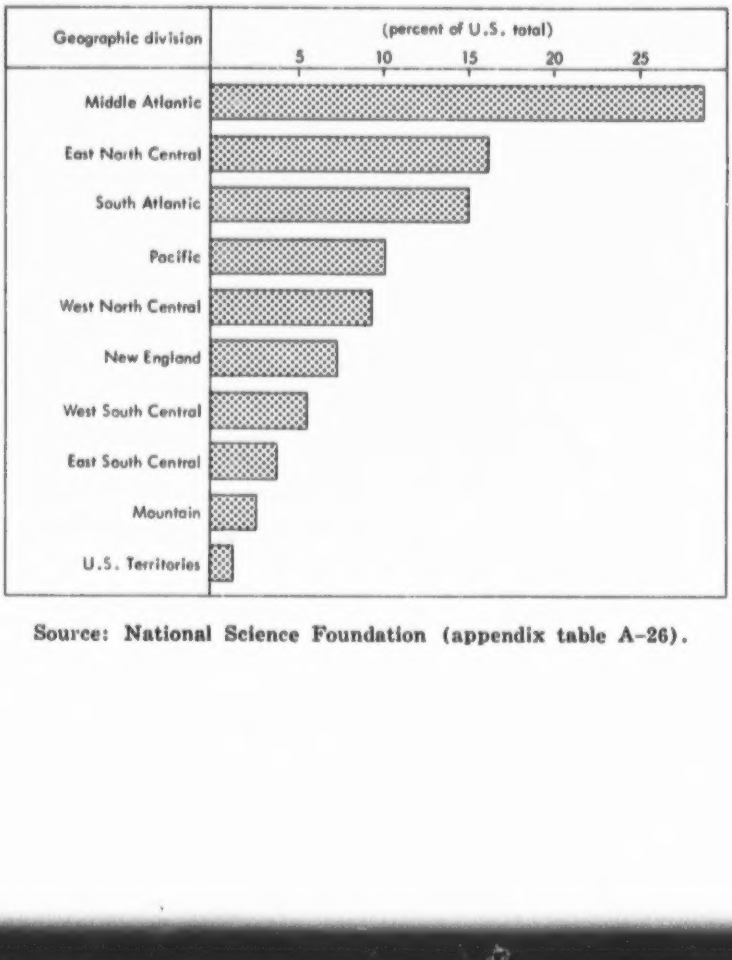
By status (full time, etc.), the proportions engaged in the three types of activities varied substantially. Of the 30,900 full-time scientists in medical schools, 44 percent were employed primarily in teaching positions, 34 percent primarily in research, and 22 percent primarily in other activities. (See appendix table A–24.) Of 16,000 part-time scientists, 61 percent were primarily teachers, 26 percent were researchers, and the remaining 14 percent were engaged in other activities. And of the 4,200 employed graduate students, 55 percent were engaged primarily in research, 40 percent in teaching, and 5 percent in other activities, January 1965.

Nearly all (99 percent) of the scientists employed at medical schools at the time of this study were life scientists. (See appendix table A–25.) By comparison, only 25 percent of the scientists and engineers in the rest of universities and colleges were working in the life sciences.

The 50,400 life scientists in medical schools represented over one-half of the total life scientists in universities and colleges in January 1965. Among them, the 41,500 medical scientists at medical schools accounted for 84 percent of the total medical scientists in universities and colleges.

Among geographic divisions, the Middle Atlantic States ranked highest in January 1965 with 29 percent of the total number of scientists in medical schools nationwide, followed by the East North Central and South Atlantic divisions, with 16 and 15 percent respectively. The Mountain division was the lowest continental division with 3 percent of the total (chart 10).

Chart 10. Distribution of scientists and engineers employed in medical schools, by geographic division, January 1965



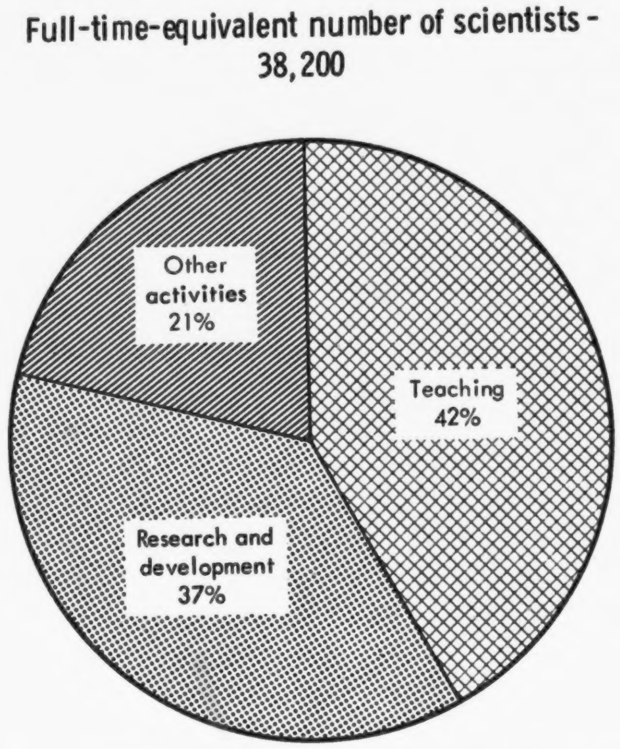
Source: National Science Foundation (appendix table A–26).

Full-time-equivalent (FTE) numbers. In terms of FTE, scientists employed by medical schools in all activities in January 1965 totaled 38,200. This amounted to almost 20 percent of the 192,600 total FTE number of scientists and engineers in all universities and colleges (table 12). Distributions of these data differed somewhat, but not much, from those of actual numbers, reflecting largely the variations in part-time work in scientific fields and functions.

The functional distribution of FTE scientists, as with actual numbers (full- and part-time personnel), differed from that of other organizational units of universities and colleges. Of the total, 42 percent were employed in teaching, 37 percent in research and development, and 21 percent in other functions (chart 11), compared with 49, 33, and 18 percent, respectively, of actual numbers. By comparison, functional distribution for the rest of the universities and colleges was 66 percent engaged in teaching, 26 percent in research and development, and 8 percent in other activities. As with actual numbers of personnel, the high percentage of scientists engaged in "other" activities is obvious. Medical schools accounted for 40 percent of the FTE scientists and engineers employed in the "other" category of activities, 26 percent of those employed in research and development, and 14 percent of teachers in all units of universities and colleges. (See table 12.)

On a geographic basis, the January 1965 distribution of the FTE scientists was similar to that of separately budgeted R&D expenditures in medical schools. The Middle Atlantic was the highest ranking division, accounting for 24 percent of the total FTE scientists in these institutions. The next largest numbers were reported by the East North Central and South Atlantic divisions, for 17 and 16 percent, respectively. Lowest were the East South Central, with 4 percent, the Mountain division, with 3 percent, and the U.S. territories, with 2 percent.

Chart 11. Distribution of full-time-equivalent number of scientists employed in medical schools, by function, January 1965



Source: National Science Foundation (appendix table A-27).

Section 7. State Agricultural Schools and Experiment Stations

Since the passage of the Hatch Act in 1887, systematic research in the agricultural sciences and related fields in the United States has been entrusted primarily to State agricultural experiment stations. This research and its applications have helped make the American farm community the most productive in the world. Agricultural experiment stations are responsible to their respective land-grant colleges and in two States to a State agricultural board. Although the stations are now supported to a large extent by State funds, current legislation still provides for a great deal of Federal funds, services, and leadership.

There are 59 main stations and hundreds of branch stations. Of the total, 45 States and the Commonwealth of Puerto Rico each operate one main station, three States operate two stations, Georgia operates three, and California has four.

The agricultural experiment stations typically are organized as autonomous departments in the State land-grant colleges; and although the stations are primarily research-oriented, their staff members often hold appointments as faculty in the schools of agriculture of these colleges. This overlapping of personnel and administrative jurisdiction tends to blur the distinction between stations and schools of agriculture, and for most purposes it is convenient to consider these two units as a single entity. Therefore, for this report, the term "agricultural experiment station" means both school and station.

Current Expenditures for Research and Development

Agricultural schools and experiment stations in 1964 allocated $236 million in current funds for research and development, with $209 million for separately budgeted research and development and $27 million in unreimbursed indirect costs and departmental research.[8] The total amount comes to 15 percent of the expenditures for research and development in all units of universities and colleges. Separately budgeted R&D expenditures were allocated as follows: Basic research, 52 percent; applied research, 42 percent; and development, 6 percent.

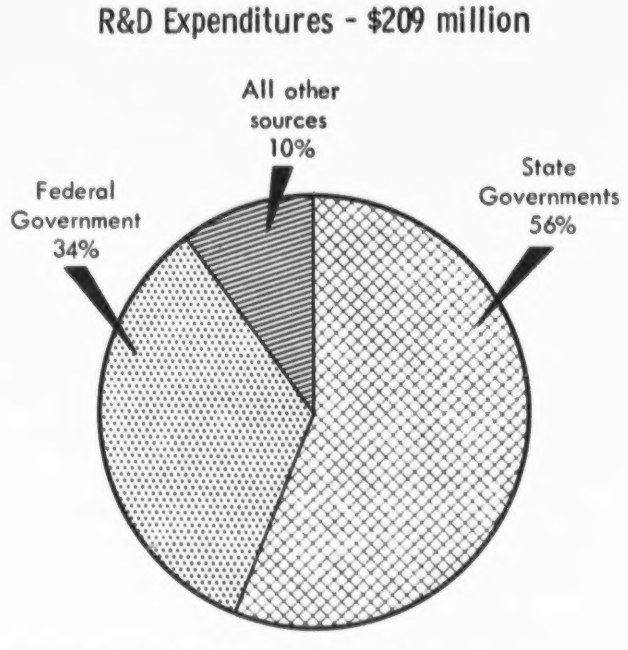
That State governments are the primary sources of research funds for the agricultural experiment stations reflects the local and regional importance of their activities. In 1964, the States provided $1.65 for every $1.00 of Federal money going to the stations. This differed from the situation in other units of universities and colleges where the principal source of R&D support was the Federal Government.

Over the years, the States and other non-Federal sources have borne an increasingly larger share of the costs of maintaining the stations. In 1887–88, the Federal Government paid 82 percent of the cost, compared with 11 percent contributed by the States and 7 percent by other sources; by 1906 less than one-half of the funds used by the experiment stations came from the Federal Government, and from 1920 to 1960 the Federal share for the stations alone fluctuated around 20 percent.[9] In recent years, however, an increase in grants and contracts to the schools of agriculture from a number of Federal agencies has resulted in an increasing proportion of Federal funds in the total for stations and schools; in 1964 the Federal Government as a whole was the source of 34 percent of their separately budgeted R&D expenditures (chart 12).

Reflecting its traditional mission, the U.S. Department of Agriculture financed 67 percent of the Federal total of $71 million. The Department of Health, Education, and Welfare ranked second in Federal R&D financing with 16 percent of the total (table 5).

Of the total of $196 million that the schools and stations allocated for research, 75 percent was spent for research in agricultural sciences, while the life sciences together accounted for 91 percent of the total. (See appendix table A-4.)

Chart 12. Distribution of current expenditures for separately budgeted research and development performed in agricultural experiment stations, by source of funds, 1964



Source: National Science Foundation.

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[8] Unreimbursed indirect costs are costs relating to sponsored research borne by the stations' own funds. Departmental research is financed jointly with instruction through budgetary allocations for "instruction and departmental research," and thus is not easily measured. Estimates of these expenditures made by reporting institutions are given here but are not included in the separately budgeted expenditures in this section.

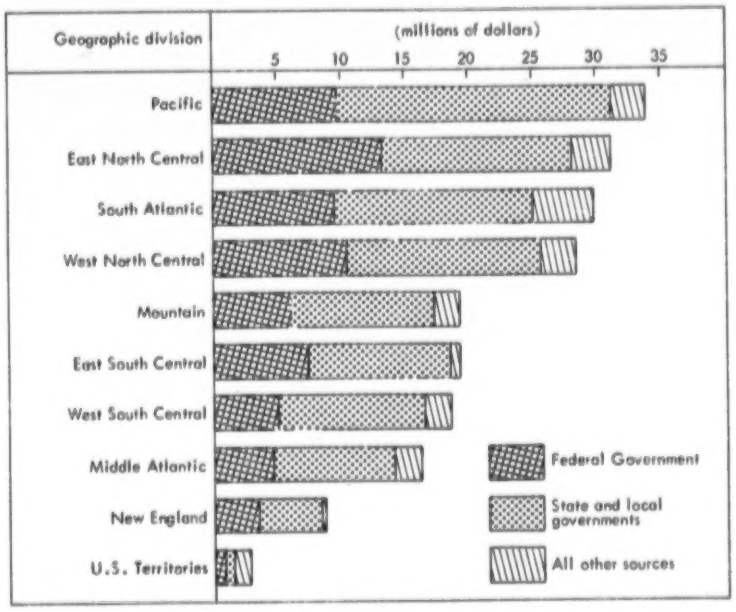
[9] Dupree, A. Hunter, *Science in the Federal Government*. Cambridge: Harvard University Press, 1957, p. 172.

In contrast to the geographic pattern characterizing the totals for universities and colleges, the highest expenditures for research and development were in the Pacific division, followed by the East North Central and South Atlantic divisions (chart 13). These three divisions together accounted for almost one-half of total current expenditures for separately budgeted research and development at all agricultural experiment stations throughout the country.

The largest share of federally financed R&D expenditures was in the East North Central division, which accounted for almost $13 million or 18 percent of the total, followed by the West North Central States with $10 million or almost 15 percent. Lowest was New England, with 5 percent.

In the volume of State R&D financing, the largest amount was reported by the Pacific States, which accounted for $21 million, or 18 percent of the $117 million total in State expenditures. This primarily reflects expenditures in the State of California, with four stations. The South Atlantic States, in second place, had more than 13 percent of the total. The lowest in State-supported research and development, as in federally supported and total research and development, was New England, which accounted for 4 percent of total State funds.

Chart 13. Current expenditures for separately budgeted research and development in agricultural experiment stations, by geographic division and source of funds, 1964



Source: National Science Foundation (appendix table A–28).

Among relative proportions in the different geographic divisions, the Federal Government share varied from 42 percent in the East North Central States to 27 percent in the West South Central States. Conversely, the East North Central division showed the lowest proportion of State funds (less than 48 percent). The highest proportion of funds supplied by State governments, 63 percent, was in the Pacific division, again reflecting California's unique situation. Funds from other sources (foundations, industrial firms, etc.) ranged from 13 percent in the Middle Atlantic States to less than 3 percent in New England (chart 13).

Current Expenditures for Instruction and Departmental Research

Agricultural experiment stations and schools of agriculture spent $63 million for direct costs of instruction and departmental research in the sciences and engineering during 1964. In addition, indirect costs allocable to these instruction and departmental research activities were estimated at about $14 million (table 9).

Life sciences again accounted for the bulk of instruction and departmental research expenditures, with 90 percent of the total. Nearly all of the remainder was in the social sciences, with 6 percent, and engineering, with 3 percent. (See appendix table A–9.)

Capital Expenditures for Scientific and Engineering Facilities and Equipment

Total capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction at agricultural experiment stations amounted to $29 million in 1964 (appendix table A–11). Of this total, $22 million, or 75 percent, came from sources outside the Federal Government, mostly from State governments.

Number of Scientists and Engineers

In January 1965, 22,400 scientists and engineers were employed in agricultural experiment stations and schools of agriculture. Of these, 71 percent were employed full time; 5 percent, employed part time; and 24 percent, part-time employed graduate students. (See table 16.)

TABLE 16.—*Scientists and engineers employed in agricultural experiment stations, by employment status and function, January 1965*

(Thousands)

Employment status	Total	Teaching	R&D	Other activities
Total	22.4	4.0	12.1	6.3
Full time	15.8	2.9	7.0	5.9
Part time	1.2	.3	.6	.3
Employed graduate students	5.4	.8	4.5	.1

Of the total scientists and engineers in agricultural institutions and stations, 18 percent were reported as primarily engaged in teaching, apparently employed primarily in the schools of agriculture.[10] In addition, 54 percent were primarily engaged in research and development, or 17 percent of the total engaged in these activities in all units of universities and colleges. The remaining 28 percent were engaged in "other" activities, including administration, extension work, and county and home demonstration work (in States where the latter are under the jurisdiction of State land-grant colleges or universities). For this reason these "other" scientists and engineers are a much larger segment of the total for agricultural experiment stations than for other units of universities and colleges.

These patterns of activity varied according to employment status. Among the 15,800 full-time scientists and engineers, 18 percent were primarily engaged in teaching; 44 percent, research and development; and 37 percent, other activities. Of the 1,200 scientists and engineers employed part time, about 25 percent were in teaching; 50 percent, research and development; and 25 percent, other activities. And of the 5,400 employed graduate students, 15 percent were in teaching; 83 percent, research and development; and 2 percent, other activities.

TABLE 17.—*Scientists and engineers employed in agricultural experiment stations, by broad field of science and employment status, January 1965*

(Thousands)

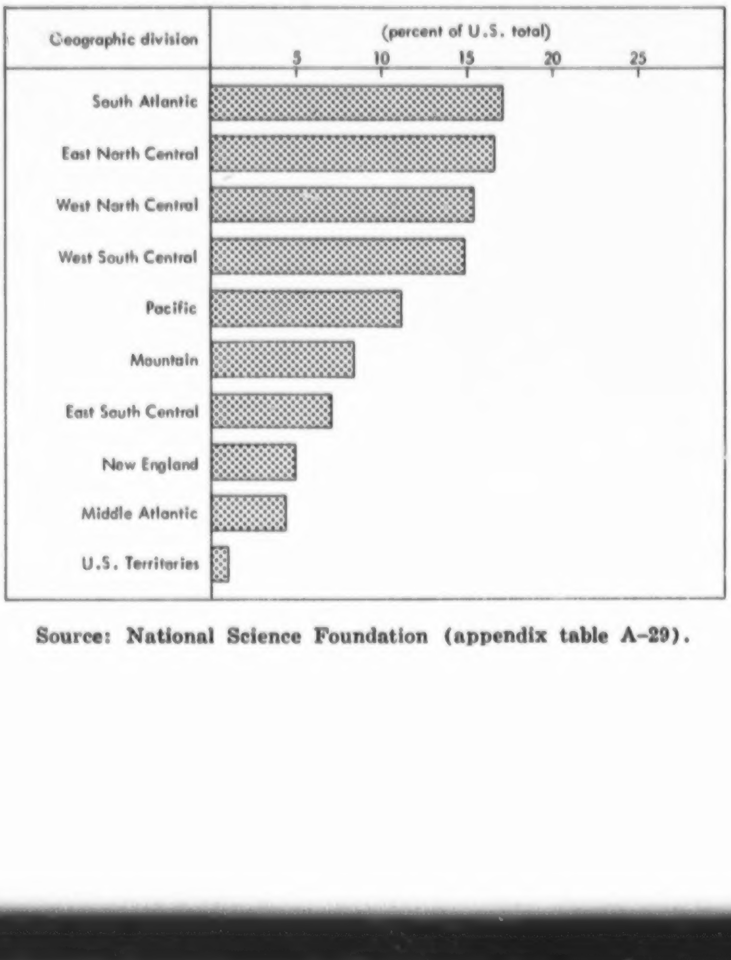
Field of science	Total	Full time	Part time	Employed graduate students
Total	22.4	15.8	1.2	5.4
Engineers	.7	.5	[a]	.2
Physical scientists	.4	.2	[a]	.1
Life scientists	19.0	13.4	1.0	4.6
Social scientists	2.0	1.4	.1	.5
Other scientists	.3	.3	—	[a]

[a] Fewer than 0.05 (50).

By far the largest proportion of the scientists and engineers at agricultural schools and experiment stations were life scientists—85 percent of the total. (See table 17.) Social scientists made up 9 percent of the total. Of the 19,000 life scientists, 15,600 or 82 percent were in the agricultural sciences. These agricultural scientists represented 85 percent of all agricultural scientists employed in all units of universities and colleges.

On a geographical basis, the highest numbers of scientists and engineers were employed in the South Atlantic division, with 17 percent of the 22,400 total, and the East North Central division, with slightly over 16 percent. Again,

Chart 14. Percent distribution of scientists and engineers employed in agricultural experiment stations, by geographic division, January 1965



Source: National Science Foundation (appendix table A-29).

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[10] U.S. Department of Agriculture, Cooperative State Research Service, *Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1964–65.* Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, 1964.

as with expenditures for research and development, the divisions with the smallest numbers were New England and the Middle Atlantic (chart 14 and appendix table A–29).

Full-time-equivalent (FTE) numbers. In full-time-equivalent terms (FTE), the number of scientists and engineers employed in agricultural schools and experiment stations reduces to 19,000. The FTE distribution by function differs from that of actual numbers largely because the latter show primary function. For example, eight full-time scientists each teaching 5 hours a day and performing research 3 hours a day would be reported in actual counts as eight teachers, but in FTE numbers they would be reported as five teachers and three researchers. Thus, of the FTE total scientists and engineers at agricultural experiment stations and associated schools of agriculture, 18 percent were engaged in teaching; 49 percent, research and development; and 32 percent, other activities (appendix table A–30).

By geographic location, the largest number of FTE scientists and engineers in the agricultural schools and stations were employed in the South Atlantic States, with 3,300 FTE scientists and engineers, or 17 percent of the total (appendix table A–30). Following were the West South Central States, with 16 percent, and the West North Central division, with 14 percent. In contrast, the three smallest divisions—New England, the Middle Atlantic States, and the territories—together accounted for only 11 percent of the U.S. total.

The distribution by function varied widely among the different divisions. These FTE scientists and engineers in teaching ranged from about 30 percent in the East North Central States to 10 percent in the West South Central States. Researchers varied from about 76 percent in the Pacific States to less than 30 percent in the West South Central States; those in other activities, from more than 60 percent in the West South Central to 5 percent in the Pacific States (appendix table A–30).

For these "other" FTE activities, agricultural extension work was estimated to account for almost 90 percent, administrative work for most of the remainder, based on the reports from a number of institutions that showed their extension personnel separately.

FEDERALLY FUNDED RESEARCH AND DEVELOPMENT CENTERS ADMINISTERED BY UNIVERSITIES AND UNIVERSITY CONSORTIA

FEDERALLY FUNDED RESEARCH and Development Centers (FFRDC's) are R&D organizations that are exclusively or substantially financed by the Federal Government and, in most instances, were established to meet a particular R&D need of a Federal agency. The FFRDC emerged as an institutional form during World War II, and with the Government's postwar expansion of scientific research and development it has continued as a device to meet specialized needs. They are managed under contract by either profit or nonprofit organizations. The supporting Federal agency determines the objectives of these organizations; the contractor provides the management and the scientific and technical direction. This section concerns 36 centers: 31 administered by individual educational institutions in 1964, and five by "university consortia," which are nonprofit organizations formed by groups of universities.[1]

Current Expenditures for Research and Development

R&D expenditures in university-administered FFRDC's increased from $141 million in 1954 to $629 million in 1964, an annual rate of 16 percent (table 18).[2] This rate was slightly higher than that of R&D expenditures in universities and colleges during the same period. Almost all of the centers' expenditures were financed by the Federal Government. In contrast, universities and colleges received 72 percent of their separately budgeted R&D funds from the Federal Government.

The distribution of separately budgeted R&D funds among the various types of R&D activities also differed greatly from the pattern of universities and colleges. Whereas the universities and colleges allocated almost four-fifths of their separately budgeted R&D funds to basic research, the centers spent only 30 percent for basic research. On the other hand, the centers spent 38 percent for development, compared with 3 percent in universities and colleges (appendix table A–3).

Most of the separately budgeted research and development at FFRDC's was financed by the Atomic Energy Commission—58 percent of the Federal total of $629 million (chart 15). The Department of Defense financed 23 percent; the National Aeronautics and Space Administration, 16 percent; and the National Science Foundation, 3 percent. Non-Federal sources provided less than 1/100 of 1 percent ($41,000). Separately budgeted R&D funds of FFRDC's were distributed as follows by type of expenditure:

	Amount	*Percent*
Total	$629.2	100
Direct costs	565.4	90
Direct salaries and wages	284.0	45
Other direct costs	281.4	45
Indirect costs reimbursed or reimbursable	63.8	10

Of total research expenditures in FFRDC's, $393 million in 1964, the physical sciences received the largest share (81 percent). Although this is not surprising, since the physical sciences are the primary fields of interest of three

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[1] See appendix B for a list of the university-administered FFRDC's covered in this survey, and the list of members of university consortia that manage five of the centers.

[2] These figures do not include current expenditures for R&D performance subcontracted to industrial firms by the Jet Propulsion Laboratory, a NASA-sponsored Federally Funded Research and Development Center managed by the California Institute of Technology.

TABLE 18.—*Estimated current expenditures for research and development in university-administered Federally Funded Research and Development Centers, by character of work, 1954–64*[a]

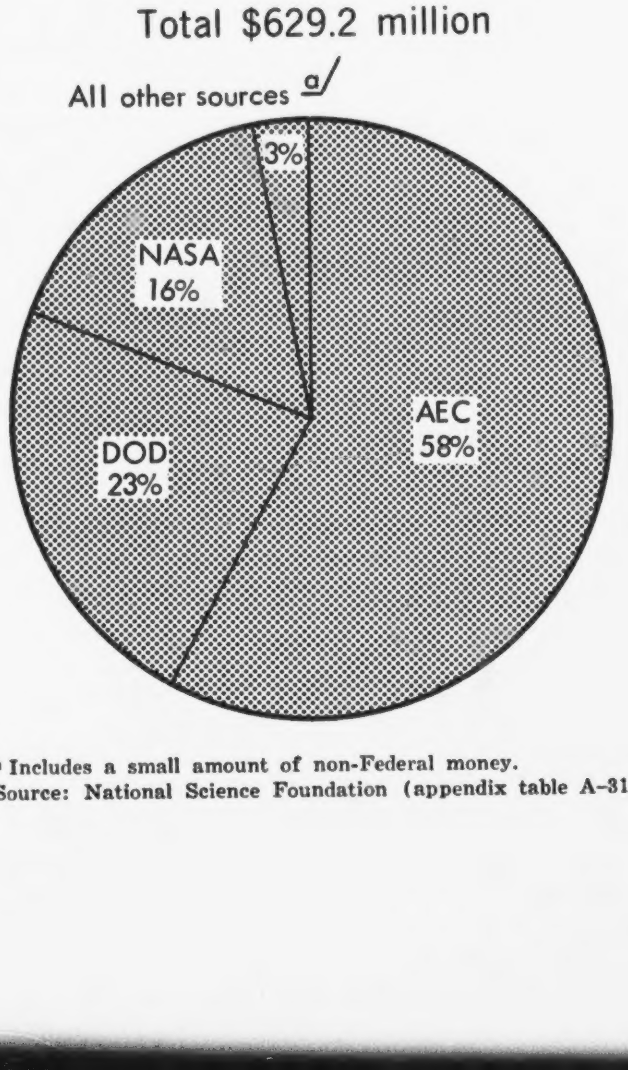
(Dollar amounts in millions)

Year	Total	Basic research		Applied research		Development	
		Amount	Percent of total	Amount	Percent of total	Amount	Percent of total
1954	$141	$39	27.7	$51	36.2	$51	36.2
1955 [b]	180	49	27.2	65	36.1	66	36.7
1956 [b]	194	51	26.3	71	36.6	72	37.1
1957 [b]	240	65	27.1	86	35.8	89	37.1
1958	293	78	26.6	102	34.8	113	38.6
1959 [b]	338	92	27.2	119	35.2	127	37.6
1960 [b]	360	97	26.9	122	33.9	141	39.2
1961 [b]	410	115	28.0	135	32.9	160	39.0
1962 [b]	470	136	28.9	155	33.0	179	38.1
1963 [b]	530	159	30.0	170	32.1	201	37.9
1964	629	191	30.4	202	32.1	236	37.5

[a] Trend data shown here relate to the university-administered Federally Funded Research and Development Centers, as designated by Federal agencies for the purpose of this survey. See appendix B for the list of these centers.

[b] Estimates derived from related information; no survey took place this year.

Chart 15. Current expenditures for separately budgeted research and development in university-administered Federally Funded Research and Development Centers, by source of funds, 1964



[a] Includes a small amount of non-Federal money.
Source: National Science Foundation (appendix table A-31).

of the four major funding agencies, it is in sharp contrast to the distribution of research funds at universities and colleges, where over one-half of the research funds were allocated to the life sciences. Among other fields, engineering received 10 percent of the total, the life sciences received 8 percent, and the social sciences and psychology together received less than 2 percent. (See appendix table A–32.)

The $629 million in separately budgeted R&D funds went to FFRDC's in all regions of the country—16 centers in the West, 8 in the Northeast, 5 in the North Central, and 7 in the South (including Puerto Rico). Data for the Puerto Rico Nuclear Center, administered by the University of Puerto Rico, were included in the Southern Region so that geographical data could be shown without releasing information reported for an individual center.

Despite variations in size of individual centers, regional distribution of their expenditures for separately budgeted research and development roughly approximates that of number of FFRDC's. The Western States reported the highest figure for separately budgeted R&D expenditures at these centers, 54 percent of the total. This figure reflects primarily the influence of California with its nine large centers (this one State accounted for $318 million, or more than one-half of the national total). Following were the Northeastern States, with 26 percent of the total; North Central, with 11 percent; and the South, including Puerto Rico, with 9 percent (table 19).

Current Expenditures for Instruction and Departmental Research

Only two of the Federally Funded Research and Development Centers in 1964 reported current funds for instruction and departmental research, amounting to $1.3 million. With very little instruction carried on in the centers, virtually all of the research in FFRDC's is separately budgeted. In these two centers, 73 percent of the total instruction and departmental research budget was allocated to the life sciences. The physical sciences accounted for almost all of the remainder. In addition, $0.3 million was reported as indirect costs allocable to the instruction and departmental research reported above.

TABLE 19.—*Selected financial and manpower characteristics of scientific activities in university-administered Federally Funded Research and Development Centers, by region, 1964 and January 1965*

Item	Total	Northeast	North Central	South [a]	West
	Number, 1964				
Federally Funded Research and Development Centers	36	8	5	7	16
	Millions of dollars, 1964				
Current expenditures, separately budgeted R&D, total	$629.2	$161.2	$72.3	$57.8	$338.0
Basic research	191.0	75.9	30.6	6.3	78.1
Applied research	201.8	44.7	12.4	14.6	130.1
Development	236.4	40.5	29.3	36.8	129.8
Capital expenditures, research, development, and instruction, total	146.9	25.0	24.1	6.1	91.7
Source of funds					
Atomic Energy Commission	110.1	24.1	24.1	.3	61.6
Department of Defense	6.4	.9	—	5.2	.3
National Aeronautics and Space Administration	27.8	—	—	.2	27.6
National Science Foundation	2.2	[b]	—	—	2.2
Non-Federal sources	.5	—	—	.5	—
	Numbers, in thousands, January 1965				
Scientists and engineers, total	11.7	2.8	1.6	1.3	6.0
Full time	10.8	2.7	1.4	1.3	5.5
Part time	.2	[c]	[c]	[c]	.2
Employed graduate students	.7	.1	.2	[c]	.3
Full-time-equivalent numbers, scientists and engineers	11.3	2.7	1.5	1.3	5.8
Technicians	8.7	2.8	1.5	.8	3.6
	Ratio to 100				
Technicians per 100 FTE scientists and engineers	77	104	100	62	62

[a] Includes Puerto Rico.

[b] Less than $50,000.

[c] Fewer than 0.05 (50).

Capital Expenditures for Scientific and Engineering Facilities and Equipment

The 36 Federally Funded Research and Development Centers reported $147 million in capital expenditures for scientific and engineering facilities and equipment for research, development, and graduate instruction in 1964. Virtually all capital expenditures were financed by the Federal Government; non-Federal sources combined accounted for less than 1 percent (table 19).

Three-fourths of the $147 million was financed by the Atomic Energy Commission, followed by the National Aeronautics and Space Administration, 19 percent; the Department of Defense, 4 percent; and the National Science Foundation, 1 percent.

The distribution of capital expenditures by field of science was similar to that of separately budgeted R&D funds for FFRDC's. The major share of capital expenditures (84 percent of the total) was used for facilities and equipment for the physical sciences, followed by engineering, with 11 percent, and the life sciences, with 5 percent. (See appendix table A–32.)

Scientists and Engineers

University-administered FFRDC's employed 11,700 scientists and engineers in January 1965. Of these, 10,800 (92 percent) were employed full time. Of the remainder, 700 or 6 percent were graduate students employed part-time as scientists and engineers and 200, or 2 percent, were other part-time scientists and engineers (table 19).

The strong orientation of the centers toward research and development is shown in the small number of scientists and engineers (only about 2 percent) who were not employed in research and development. In contrast, more than three-fifths of all scientists and engineers in universities and colleges were primarily engaged in teaching.

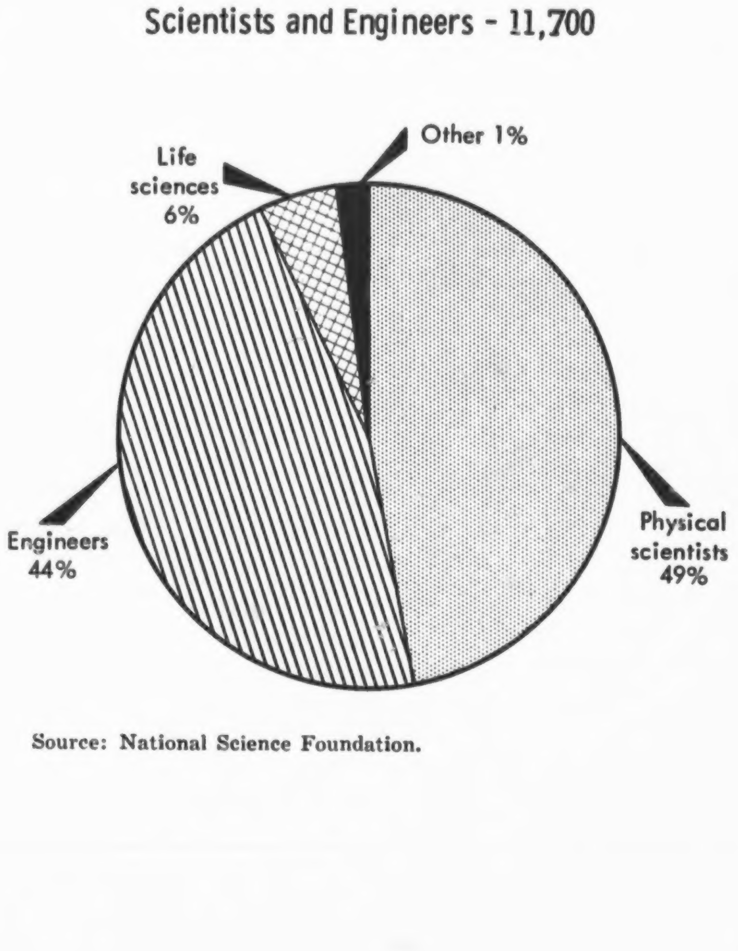
The distribution among broad fields of employment in university-administered FFRDC's also differed considerably from that of universities and colleges. Physical scientists constituted the largest number, amounting to 49 percent, followed by engineers with 44 percent and much smaller proportions of life scientists, psychologists, and social scientists (altogether amounting to 7 percent) (chart 16). In contrast, 40 percent of the scientists and engineers at universities and colleges were life scientists. This concentration in the physical sciences and engineering at the centers, as in the expenditures, reflects the mission orientation of the Federal agencies that support their activities.

The geographic distribution of scientists and engineers employed in FFRDC's, similar to that of R&D funds, shows the Western States highest with 6,000, or 51 percent of the total, followed by the Northeast with 2,800, or 24 percent; North Central with 1,600, or 14 percent; and the Southern States and Puerto Rico with 1,300, or 11 percent.

The geographic distribution was the same for the full-time and the few part-time scientists and engineers. The part-time-employed graduate students, however, differed somewhat, with the order: West, still in first place; then North Central and Northeast.

Since nearly all of the scientists and engineers employed by the FFRDC's held full-time appointments, the actual number (11,700) re-

Chart 16. Distribution of scientists and engineers employed in university-administered Federally Funded Research and Development Centers, by field, January 1965



Source: National Science Foundation.

duces only to 11,300 in full-time-equivalent numbers. Thus, the FTE total is 97 percent of the actual count, whereas in the universities and colleges the FTE number of scientists and engineers was only 77 percent of the actual count.

In terms of activities, FTE scientists and engineers were distributed as follows:

	Number	*Percent*
Total	11,300	100
In R&D	11,100	98
In other activities	200	2

Thus, the 98 percent of the FTE scientists and engineers engaged in research and development is very slightly lower than the ratio of research and development to total in the case of separate individuals, indicating that some who were primarily engaged in R&D activities performed some other functions part time.

Technicians

In January 1965, FFRDC's administered by universities employed 8,700 technicians, nearly all primarily engaged in research and development.

By field of science, they were distributed as follows:

	Number	*Percent*
Total	8,700	100
Engineering and physical science technicians	7,700	89
Life science technicians	800	9
Other technicians	200	2

Thus, as with scientists and engineers, technician employment was heavily concentrated in engineering and the physical sciences.

As a ratio, technicians averaged 77 per 100 scientists and engineers in university-administered FFRDC's. Regionally, the average ranged from 62 technicians per 100 scientists and engineers in the South and West to 104 per 100 in the Northeast.

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TABLE A–1.—*Estimated current expenditures for research and development in universities and colleges, by source of funds, 1954–64*

(Millions of dollars)

Year [a]	Total, all sources	Separately budgeted R&D expenditures					Other [b]
		Total	Federal Government	Industry	Other nonprofit institutions	Institutions' own funds	
1954	$377	$290	$160	$22	$28	$80	$87
1955 [c]	409	312	169	25	30	88	97
1956 [c]	480	372	213	29	34	96	108
1957 [c]	531	410	229	34	38	109	121
1958	592	456	254	39	42	121	136
1959 [c]	682	526	306	39	47	134	156
1960 [c]	825	646	405	40	52	149	179
1961 [c]	969	763	500	40	58	165	206
1962 [c]	1,143	904	613	40	66	185	239
1963 [c]	1,359	1,081	760	41	73	207	278
1964	1,595	1,272	917	41	83	232	323

[a] Academic year ending in the year shown; for example, 1954 refers to "academic year 1953–54."

[b] Includes estimates for departmental research and for other research activities for which universities and colleges do not maintain separate records.

[c] Estimates derived from related information; no sector survey took place this year.

TABLE A–2.—*Estimated current expenditures for research and development in universities and colleges, by character of work, 1954–64*[a]

(Dollar amounts in millions)

Year [b]	Total	Basic research		Applied research		Development	
		Amount	Percent of total	Amount	Percent of total	Amount	Percent of total
1954	$377	$206	54.6	$154	40.8	$17	4.5
1955 [c]	409	237	57.9	155	37.9	17	4.2
1956 [c]	480	286	59.6	169	35.2	25	5.2
1957 [c]	531	337	63.5	169	31.8	25	4.7
1958	592	390	65.9	175	29.6	27	4.6
1959 [c]	682	468	68.6	186	27.3	28	4.1
1960 [c]	825	576	69.8	215	26.1	34	4.1
1961 [c]	969	701	72.3	233	24.0	35	3.6
1962 [c]	1,143	850	74.4	253	22.1	40	3.5
1963 [c]	1,359	1,036	76.2	283	20.8	40	2.9
1964	1,595	1,261	79.1	294	18.4	40	2.5

[a] Includes estimates for departmental research and for other research activities for which most universities and colleges do not maintain separate records.

[b] Academic year ending in year shown; for example, 1954 refers to "academic year 1953–54."

[c] Estimates derived from related information; no sector survey took place this year.

TABLE A–3.—*Current expenditures for separately budgeted research and development in universities and colleges, by source of funds and character of work, 1964*

(Millions of dollars)

Source of funds	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
	Basic research, applied research, and development				
All sources	$1,272.4	$1,259.6	$12.8	$351.1	$208.7
Federal Government	917.3	907.3	10.0	284.0	71.0
State and local governments	173.2	172.7	.5	11.5	117.1
Foundations and voluntary health agencies	61.4	60.5	.9	29.5	2.8
Industry	40.4	39.8	.5	8.0	8.2
Institutions' own funds	58.9	58.0	.9	9.4	6.7
Other sources	21.3	21.2	.1	8.6	2.9
	Basic research				
All sources	1,003.0	994.0	8.9	300.2	108.8
Federal Government	766.2	759.3	7.0	247.3	40.3
State and local governments	98.2	97.8	.3	8.5	57.9
Foundations and voluntary health agencies	51.6	50.9	.6	24.1	1.4
Industry	24.8	24.5	.4	5.7	4.1
Institutions' own funds	46.9	46.4	.6	7.8	4.1
Other sources	15.2	15.2	.1	6.8	1.0
	Applied research				
All sources	231.9	228.5	3.4	45.7	87.5
Federal Government	128.4	125.8	2.6	32.9	25.9
State and local governments	66.8	66.6	.1	3.0	52.7
Foundations and voluntary health agencies	8.5	8.3	.2	5.3	1.4
Industry	13.6	13.4	.1	2.0	3.9
Institutions' own funds	9.3	9.0	.2	.9	2.0
Other sources	5.3	5.3	[b]	1.5	1.7
	Development				
All sources	37.6	37.1	.5	5.2	12.5
Federal Government	22.7	22.3	.4	3.8	4.9
State and local governments	8.2	8.2	[b]	.1	6.5
Foundations and voluntary health agencies	1.3	1.3	[b]	.2	[b]
Industry	2.0	1.9	[b]	.2	.3
Institutions' own funds	2.7	2.7	[b]	.7	.6
Other sources	.8	.8	[b]	.2	.2

[a] Includes medical schools and agricultural experiment stations.

[b] Less than $50,000.

TABLE A–4.—*Current expenditures for separately budgeted basic and applied research in universities and colleges, by source of funds and detailed field of science, 1964*

(Millions of dollars)

Source of funds and field of science	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
All sources	$1,234.8	$1,222.5	$12.3	$345.9	$196.3
Engineering	156.6	155.8	.8	---------	3.5
Physical sciences	293.5	289.5	4.0	[b]	3.6
Chemistry	68.5	67.0	1.6	[b]	3.1
Earth sciences	52.4	52.2	.2	---------	.2
Physics	117.4	115.8	1.6	---------	.1
Mathematics	28.3	27.8	.6	[b]	.2
Other physical sciences	26.8	26.8	.1	---------	---------
Life sciences	660.1	655.9	4.2	345.5	179.1
Agricultural sciences	161.9	161.9	[a]	---------	146.8
Biological sciences	183.1	180.2	2.9	76.4	26.4
Medical sciences	315.1	313.8	1.3	269.0	5.9
Psychology	31.3	29.7	1.6	.4	.2
Social sciences	78.9	77.8	1.1	[b]	9.4
Other sciences	14.4	13.8	.6	---------	.4
Federal Government	894.6	885.1	9.5	280.2	66.1
Engineering	124.9	124.6	.4	---------	1.2
Physical sciences	253.2	249.9	3.3	[b]	1.3
Chemistry	54.6	53.4	1.2	[b]	1.2
Earth sciences	43.4	43.2	.2	---------	.1
Physics	108.3	107.0	1.3	---------	[b]
Mathematics	25.1	24.6	.6	---------	[b]
Other physical sciences	21.8	21.7	.1	---------	---------
Life sciences	443.4	440.1	3.3	279.8	59.1
Agricultural sciences	50.5	50.5	[b]	---------	44.9
Biological sciences	141.1	138.6	2.5	64.4	10.9
Medical sciences	251.8	251.0	.8	215.4	3.3
Psychology	27.0	25.5	1.5	.3	.1
Social sciences	41.0	40.3	.6	[b]	4.3
Other sciences	5.1	4.7	.4	---------	.2

TABLE A-4.—Continued

Source of funds and fields of science	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Non-Federal sources	340.3	337.5	2.8	65.7	130.1
Engineering	31.7	31.2	.5	----------	2.3
Physical sciences	40.3	39.7	.6	[b]	2.3
Chemistry	14.0	13.6	.4	----------	1.9
Earth sciences	9.0	9.0	[b]	----------	.1
Physics	9.1	8.8	.2	----------	.1
Mathematics	3.2	3.2	[b]	[b]	.2
Other physical sciences	5.0	5.0	[b]	----------	----------
Life sciences	216.7	215.8	.9	65.6	120.0
Agricultural sciences	111.4	111.4	[b]	----------	101.9
Biological sciences	42.0	41.6	.4	12.0	15.4
Medical sciences	63.3	62.8	.5	53.6	2.6
Psychology	4.3	4.2	.1	[b]	.1
Social sciences	37.9	37.4	.5	----------	5.1
Other sciences	9.3	9.1	.2	----------	.3

[a] Includes medical schools and agricultural experiment stations.

[b] Less than $50,000.

TABLE A-5.—*Geographic distribution of current expenditures for separately budgeted research and development in universities and colleges, by source of funds, 1964*

(Millions of dollars)

Geographic location	Total	Federal Government	State and local governments	Other
UNITED STATES, TOTAL	$1,272.4	$917.3	$173.2	$181.9
NORTHEAST	403.2	317.1	30.4	55.7
New England	146.1	118.6	6.4	21.1
Maine	2.7	1.5	.9	.3
New Hampshire	5.1	4.4	.4	.3
Vermont	2.9	2.3	.5	.1
Massachusetts	99.4	81.4	1.7	15.3
Rhode Island	8.9	7.7	.6	.6
Connecticut	27.0	21.3	2.2	3.5
Middle Atlantic	257.1	198.5	24.0	34.6
New York	149.5	120.3	10.6	18.6
New Jersey	36.6	23.4	8.0	5.2
Pennsylvania	71.0	54.8	5.4	10.8
NORTH CENTRAL	322.8	230.2	42.0	50.7
East North Central	230.7	172.3	21.2	37.2
Ohio	39.3	29.0	3.3	7.0
Indiana	26.5	19.3	2.7	4.5
Illinois	77.5	59.3	7.5	10.7
Michigan	52.2	42.5	.5	9.2
Wisconsin	35.3	22.2	7.1	6.0
West North Central	92.0	57.8	20.8	13.4
Minnesota	23.4	17.1	3.1	3.2
Iowa	17.8	11.2	4.0	2.6
Missouri	22.8	14.9	4.4	3.5
North Dakota	3.6	1.9	1.1	.6
South Dakota	3.6	2.2	1.2	.2
Nebraska	7.0	3.0	3.2	.8
Kansas	13.9	7.6	3.9	2.4
SOUTH	270.5	177.7	47.2	45.7
South Atlantic	146.2	99.2	20.6	26.4
Delaware	2.9	1.6	.4	.9
Maryland	36.0	28.7	2.5	4.8
District of Columbia	12.8	11.2	[a]	1.6
Virginia	$14.1	$ 9.3	$ 2.4	$ 2.4
West Virginia	3.5	1.9	1.0	.6
North Carolina	27.1	18.2	4.3	4.6
South Carolina	47	2.6	1.3	.8
Georgia	18.1	9.9	1.6	6.6
Florida	27.1	15.8	7.1	4.2
East South Central	45.0	28.6	12.0	4.4
Kentucky	8.7	4.8	3.1	.8
Tennessee	18.6	13.0	3.8	1.8
Alabama	11.0	6.9	3.2	.9
Mississippi	6.7	4.0	2.0	.7
West South Central	79.3	49.8	14.6	14.9
Arkansas	6.6	3.4	1.9	1.3
Louisiana	18.2	11.7	4.2	2.3
Oklahoma	10.8	6.6	2.4	1.8
Texas	43.6	23.2	6.1	9.3
WEST	270.2	188.9	51.7	29.7
Mountain	73.7	47.0	18.2	8.5
Montana	3.8	1.6	1.8	.4
Idaho	3.8	1.5	2.1	.2
Wyoming	3.1	1.0	.7	1.4
Colorado	20.3	15.9	1.6	2.8
New Mexico	14.6	11.4	2.5	.7
Arizona	14.4	6.6	5.9	1.9
Utah	11.1	7.8	2.5	.8
Nevada	2.6	1.2	1.1	.3
Pacific	196.5	141.8	33.5	21.2
Washington	24.3	16.3	5.5	2.5
Oregon	15.8	10.8	3.2	1.8
California	144.8	108.3	21.8	14.7
Alaska	4.2	2.3	.5	1.4
Hawaii	7.3	4.2	2.4	.7
U.S. territories	5.8	3.5	1.9	.4

[a] Less than $50,000.

√

TABLE A–6.—*Current expenditures for separately budgeted basic and applied research in universities and colleges, by geographic location and broad field of science, 1964*

(Millions of dollars)

Geographic region and division	Total	Engineering	Physical sciences	Life sciences	Psychology	Social sciences	Other sciences
United States, total	$1,234.8	$156.6	$293.5	$660.1	$31.3	$78.9	$14.4
Northeast	396.7	55.0	106.8	191.4	10.8	27.1	5.5
New England	141.9	22.7	43.1	56.7	4.5	10.5	4.4
Middle Atlantic	254.7	32.3	63.7	134.7	6.3	16.6	1.1
North Central	311.9	43.2	68.4	161.7	9.9	26.3	2.5
East North Central	225.6	37.2	50.9	107.8	6.8	21.0	1.9
West North Central	86.2	5.9	17.4	53.8	3.1	5.3	.6
South	261.8	22.9	41.4	179.8	6.8	9.5	1.3
South Atlantic	145.6	14.2	26.5	95.2	4.3	4.1	1.2
East South Central	42.3	3.3	2.2	33.7	1.2	2.0	----------
West South Central	74.0	5.5	12.8	50.9	1.4	3.4	----------
West	258.9	35.2	76.1	123.4	3.7	15.2	5.1
Mountain	68.2	13.9	18.4	30.2	1.2	3.8	.7
Pacific	190.7	21.3	57.7	93.2	2.5	11.5	4.4
U.S. territories	5.7	.3	.8	4.0	----------	.7	----------

TABLE A–7.—*Current expenditures for separately budgeted research and development in universities and colleges, by type of expenditure, 1964*

(Millions of dollars)

Type of expenditure	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Total	$1,272.4	$1,259.6	$12.8	$351.1	$208.7
Total direct costs	1,134.4	1,122.8	11.6	310.6	204.3
Direct salaries and wages	677.1	670.8	6.3	177.4	145.1
All other direct costs	457.3	452.0	5.3	133.2	59.2
Indirect costs reimbursed or reimbursable	138.1	136.8	1.3	40.5	4.5

[a] Includes medical schools and agricultural experiment stations.

TABLE A–8.—*Current direct expenditures for instruction and departmental research in the sciences and engineering in universities and colleges, by type of control, 1964*

(Millions of dollars)

Type of control	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Total	$1,553.1	$1,275.4	$277.7	$253.0	$63.3
Public	963.5	818.3	145.2	132.4	63.3
Private	589.6	457.2	132.4	120.6	[b]

[a] Includes medical schools and agricultural experiment stations.

[b] All of the agricultural experiment stations are under public control.

TABLE A–9.—*Current direct expenditures for instruction and departmental research in the sciences and engineering in universities and colleges, by broad field of science, 1964*

(Millions of dollars)

Field of science	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Total	$1,553.1	$1,275.4	$277.7	$253.0	$63.3
Engineering	213.1	182.5	30.6	----------	1.8
Physical sciences	357.1	269.3	87.8	.2	.6
Life sciences	571.5	517.0	54.6	252.3	57.2
Psychology	70.9	50.8	20.1	.5	----------
Social sciences	283.3	206.3	77.0	[b]	3.5
Other sciences	57.2	49.6	7.6	----------	.1

[a] Includes medical schools and agricultural experiment stations.

[b] Less than $50,000.

TABLE A–10.—*Geographic distribution of current direct expenditures for instruction and departmental research in the sciences and engineering in universities and colleges, 1964*

(Millions of dollars)

Geographic location	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions
UNITED STATES, TOTAL	$1,553.1	$1,275.4	$277.7
NORTHEAST	423.7	352.2	71.5
New England	137.3	118.0	19.3
Maine	4.6	3.1	1.5
New Hampshire	6.7	6.0	.8
Vermont	5.2	3.9	1.2
Massachusetts	84.5	74.1	10.4
Rhode Island	7.5	6.8	.7
Connecticut	28.8	24.2	4.6
Middle Atlantic	286.4	234.2	52.2
New York	171.8	140.4	31.3
New Jersey	27.8	23.9	4.0
Pennsylvania	86.8	69.9	16.9
NORTH CENTRAL	445.2	372.7	72.6
East North Central	310.1	262.4	47.7
Ohio	80.9	70.2	10.7
Indiana	52.0	46.8	5.2
Illinois	84.1	72.3	11.9
Michigan	65.8	55.0	10.8
Wisconsin	27.3	18.0	9.2
West North Central	135.1	110.3	24.8
Minnesota	29.9	24.2	5.7
Iowa	28.2	22.8	5.5
Missouri	29.2	22.6	6.6
North Dakota	4.4	3.3	1.1
South Dakota	7.2	6.0	1.2
Nebraska	10.8	9.4	1.4
Kansas	25.5	22.1	3.4
SOUTH	378.4	299.1	79.4
South Atlantic	184.1	137.0	47.1
Delaware	4.0	3.9	.1
Maryland	23.8	14.3	9.5
District of Columbia	17.0	15.4	1.6
Virginia	$ 21.3	$ 15.9	$ 5.5
West Virginia	12.4	9.6	2.8
North Carolina	41.1	31.4	9.6
South Carolina	11.5	8.3	3.2
Georgia	19.4	14.4	5.0
Florida	33.6	23.7	9.9
East South Central	74.3	61.2	13.1
Kentucky	19.5	15.1	4.4
Tennessee	25.0	21.8	3.2
Alabama	19.6	16.9	2.7
Mississippi	10.3	7.3	2.9
West South Central	120.0	100.9	19.1
Arkansas	8.4	5.1	3.3
Louisiana	33.2	31.3	1.9
Oklahoma	17.5	14.6	2.9
Texas	60.8	49.8	11.0
WEST	296.8	243.3	53.5
Mountain	89.4	80.7	8.7
Montana	3.7	2.9	.8
Idaho	4.0	3.1	.9
Wyoming	4.2	3.8	.4
Colorado	22.4	18.1	4.4
New Mexico	5.8	5.3	.4
Arizona	20.2	19.3	.9
Utah	26.4	25.5	1.0
Nevada	2.9	2.9	-----
Pacific	207.3	162.5	44.8
Washington	28.4	23.5	4.9
Oregon	15.4	11.7	3.7
California	158.7	122.8	36.0
Alaska	1.2	1.1	.1
Hawaii	3.6	3.4	.1
U.S. territories	8.9	8.2	.7

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[a] Includes medical schools and agricultural experiment stations.

TABLE A–11.—*Capital expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by source of funds and broad field of science, 1964*

(Millions of dollars)

Source of funds and field of science	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
All sources	$529.5	$450.6	$78.9	$105.6	$29.4
Engineering	71.7	58.1	13.6	---	.7
Physical sciences	153.5	121.1	32.4	[b]	1.2
Life sciences	232.0	210.2	21.8	105.6	26.9
Social sciences	32.6	24.8	7.8	---	.4
Other sciences	39.7	36.3	3.4	[b]	.2
Federal Government	134.4	128.5	5.9	48.5	7.3
Engineering	10.9	10.2	.7	---	.1
Physical sciences	33.8	30.9	2.9	[b]	.2
Life sciences	81.7	80.1	1.6	48.5	6.9
Social sciences	2.0	1.5	.5	---	.1
Other sciences	6.1	5.8	.3	[b]	[b]
Non-Federal sources	395.1	322.0	73.0	57.1	22.0
Engineering	60.8	47.9	12.8	---	.6
Physical sciences	119.7	90.2	29.5	---	1.0
Life sciences	150.3	130.1	20.3	57.1	20.0
Social sciences	30.6	23.3	7.3	---	.2
Other sciences	33.7	30.5	3.2	[b]	.2

[a] Includes medical schools and agricultural experiment stations.
[b] Less than $50,000.

TABLE A–12.—*Federally financed capital expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by Federal agency, 1964*

(Millions of dollars)

Federal agency	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
Total	$134.4	$128.5	$5.9	$48.5	$7.3
Atomic Energy Commission	4.3	3.9	.4	.4	.2
Department of Agriculture	1.9	1.9	---	[b]	1.7
Department of Defense	6.4	5.9	.5	.5	[b]
Department of Health, Education, and Welfare	72.3	70.6	1.7	45.5	2.4
National Aeronautics and Space Administration	5.2	5.1	.1	.5	.1
National Science Foundation	39.9	37.4	2.5	1.2	1.5
Other agencies	4.4	3.7	.8	.4	1.4

[a] Includes medical schools and agricultural experiment stations.
[b] Less than $50,000.

TABLE A–13.—*Capital expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by source of funds, purpose, and broad field of science, 1964*

(Millions of dollars)

Source of funds and purpose	Total	Engineering	Physical sciences	Life sciences	Social sciences	Other sciences
All sources	$529.5	$71.7	$153.5	$232.0	$32.6	$39.7
R&D and graduate instruction	289.0	27.6	75.1	160.0	10.8	15.6
Undergraduate instruction	240.5	44.1	78.4	72.0	21.8	24.2
Federal Government	134.4	10.9	33.8	81.7	2.0	6.1
R&D and graduate instruction	108.1	8.5	26.5	67.0	1.3	4.9
Undergraduate instruction	26.3	2.5	7.3	14.7	.8	1.2
Non-Federal sources	395.1	60.8	119.7	150.3	30.6	33.7
R&D and graduate instruction	180.9	19.1	48.6	93.0	9.5	10.7
Undergraduate instruction	214.2	41.7	71.1	57.3	21.1	23.0

TABLE A–14.—*Geographic distribution of capital expenditures for research, development, and instruction in the sciences and engineering in universities and colleges, by source of funds and purpose, 1964*
(Millions of dollars)

State	All sources			Federal sources			Non-Federal sources		
	Total	R&D and graduate instruction	Undergraduate instruction	Total	R&D and graduate instruction	Undergraduate instruction	Total	R&D and graduate instruction	Undergraduate instruction
UNITED STATES, TOTAL	$529.5	$289.0	$240.5	$134.4	$108.1	$26.3	$395.1	$180.9	$214.2
NORTHEAST	147.2	86.3	60.9	38.9	30.7	8.2	108.3	55.6	52.7
New England	39.6	29.5	10.0	13.2	10.5	2.6	26.4	19.0	7.4
Maine	.7	.2	.5	.2	.1	.1	.5	.1	.4
New Hampshire	3.0	2.0	1.1	1.5	1.1	.4	1.6	.9	.7
Vermont	.7	.4	.2	.5	.4	.1	.2	[a]	.2
Massachusetts	21.6	15.0	6.6	6.9	5.1	1.8	14.7	9.9	4.9
Rhode Island	1.6	1.3	.3	.6	.6	[a]	1.0	.7	.3
Connecticut	11.9	10.7	1.2	3.5	3.3	.2	8.4	7.4	1.0
Middle Atlantic	107.6	56.7	50.9	25.7	20.1	5.6	81.9	36.6	45.4
New York	79.3	44.7	34.7	15.5	12.9	2.6	63.8	31.8	32.1
New Jersey	10.1	3.2	6.8	2.7	2.1	.6	7.3	1.1	6.2
Pennsylvania	18.2	8.8	9.4	7.5	5.1	2.4	10.8	3.7	7.1
NORTH CENTRAL	152.8	73.6	79.2	39.2	31.5	7.7	113.5	42.1	71.5
East North Central	108.8	49.5	59.3	29.4	23.1	6.4	79.3	26.4	52.9
Ohio	13.2	6.2	7.1	4.0	2.8	1.2	9.3	3.4	5.9
Indiana	11.1	4.9	6.1	3.2	3.0	.2	7.9	1.9	6.0
Illinois	42.1	15.6	26.4	8.7	6.5	2.3	33.3	9.2	24.2
Michigan	23.7	15.4	8.4	8.7	7.8	.9	15.0	7.5	7.5
Wisconsin	18.7	7.4	11.3	4.9	3.0	1.9	13.8	4.4	9.4
West North Central	44.0	24.1	19.9	9.8	8.4	1.4	34.2	15.7	18.5
Minnesota	11.4	6.6	4.9	3.7	3.3	.3	7.8	3.2	4.5
Iowa	12.2	7.6	4.6	1.9	1.6	.3	10.4	6.1	4.3
Missouri	7.3	4.9	2.5	1.7	1.5	.2	5.6	3.3	2.3
North Dakota	1.0	.4	.6	.2	.2	.1	.8	.3	.5
South Dakota	1.6	.4	[illegible]	.2	.2	[a]	1.3	.2	1.2
Nebraska	3.6	1.7	1.9	.8	.6	.2	2.9	1.2	1.7
Kansas	6.8	2.5	4.3	1.3	1.0	.3	5.5	1.5	4.0
SOUTH	10[illegible].6	60.2	45.5	31.2	24.5	6.7	74.5	35.7	38.8
South Atlantic	43.9	25.1	18.8	12.7	9.3	3.4	31.2	15.9	15.3
Delaware	2.9	.5	1.4	.2	.2	—	1.7	.3	1.4
Maryland	6.9	5.5	1.3	2.3	1.6	.7	4.5	3.9	.7
District of Columbia	3.8	1.9	1.9	1.7	1.0	.7	2.1	.9	1.2
Virginia	4.4	2.3	2.1	.7	.4	.3	3.7	1.9	1.8
West Virginia	4.0	1.7	2.3	1.5	.8	.8	2.5	1.0	1.5
North Carolina	7.9	5.6	2.3	1.8	1.6	.2	6.1	4.0	2.1
South Carolina	1.1	.8	.3	.3	.3	.1	.8	.5	.3
Georgia	4.3	2.4	1.9	1.5	1.2	.3	2.8	1.2	1.6
Florida	9.6	4.4	5.2	2.7	2.3	.4	6.9	2.1	4.8
East South Central	28.0	14.2	13.8	8.1	6.1	2.0	19.9	8.1	11.8
Kentucky	2.4	1.4	1.1	.8	.6	.2	1.7	.8	.9
Tennessee	11.7	6.2	5.5	3.4	2.5	.9	8.3	3.7	4.6
Alabama	5.9	1.7	4.2	1.8	1.3	.6	4.1	.4	3.7
Mississippi	7.9	5.0	2.9	2.1	1.8	.3	5.9	3.2	2.7
West South Central	33.8	20.9	12.9	10.4	9.1	1.3	23.4	11.8	11.6
Arkansas	1.7	.7	1.0	.9	.6	.2	.9	.1	.8
Louisiana	5.3	3.8	1.5	2.8	2.6	.3	2.5	1.2	1.3
Oklahoma	9.3	6.3	3.0	1.1	1.1	.1	8.2	5.2	2.9
Texas	17.4	10.1	7.3	5.6	4.8	.7	11.9	5.3	6.6
WEST	123.2	68.5	54.7	24.9	21.3	3.6	98.3	47.3	51.1
Mountain	18.3	9.4	8.9	5.5	4.5	1.0	12.8	4.9	7.9
Montana	.6	.4	.2	.2	.2	.1	.4	.2	.2
Idaho	3.3	1.2	2.1	.1	.1	[a]	3.2	1.2	2.0
Wyoming	.2	[a]	.1	.1	[a]	.1	.1	[a]	.1
Colorado	6.3	2.5	3.8	1.5	1.0	.4	4.9	1.5	3.4
New Mexico	1.4	1.1	.2	.8	.8	.1	.5	.4	.2
Arizona	2.1	1.4	.8	.7	.6	.1	1.4	.8	.7
Utah	3.9	2.4	1.5	1.8	1.7	.2	2.1	.8	1.3
Nevada	.4	.3	.1	.2	.1	.1	.2	.2	[a]
Pacific	104.9	59.1	45.8	19.4	16.8	2.6	85.5	42.3	43.2
Washington	8.8	6.0	2.7	2.8	2.6	.1	6.0	3.4	2.6
Oregon	4.1	2.9	1.2	2.4	2.1	.3	1.7	.8	.9
California	88.9	47.4	41.5	12.2	10.0	2.1	76.8	37.4	39.4
Alaska	1.0	.8	.1	.4	.3	[a]	.6	.5	.1
Hawaii	2.2	1.9	.2	1.7	1.7	[a]	.5	.2	.2
U.S. territories	7	.5	.2	.3	.2	.1	.4	.3	.1

[a] Fewer than 0.05 (50).

TABLE A–15.—*Scientists and engineers employed in universities and colleges classified by highest degree granted in the sciences and engineering, by broad field of science, January 1965*

(Thousands)

Institutions classified by highest degree granted in the sciences and engineering	Total	Engineers	Physical scientists	Life scientists	Psychologists	Social scientists	Other scientists
Total	250.0	32.4	62.4	100.7	12.7	40.7	1.1
Doctorate	185.3	25.2	40.9	88.7	7.1	22.9	.5
Master's	24.9	3.0	8.7	4.8	2.2	6.1	—
Bachelor's	22.6	1.6	7.6	3.9	1.9	7.2	.4
No science degree	17.2	2.6	5.1	3.3	1.5	4.5	.3

TABLE A–16.—*Scientists and engineers employed in universities and colleges, by employment status, detailed field of science, and function, January 1965*

(Thousands)

Employment status and field of science	Total	Teaching	R&D	Other activities
All scientists and engineers	250.0	158.4	69.9	21.8
Engineers	32.4	20.3	10.8	1.2
Physical scientists	62.4	44.8	16.3	1.3
Chemists	19.4	13.0	5.9	.5
Earth scientists	6.3	4.3	1.8	.2
Physicists	15.9	10.1	5.6	.3
Mathematicians	18.6	16.4	1.9	.3
Other physical scientists	2.2	1.0	1.1	.1
Life scientists	100.7	49.4	34.9	16.3
Agricultural scientists	18.3	3.9	8.8	5.7
Biological scientists	32.9	19.4	12.4	1.0
Medical scientists	49.4	26.1	13.6	9.7
Psychologists	12.7	9.4	2.7	.7
Social scientists	40.7	33.8	5.1	1.9
Other scientists	1.1	.7	.1	.4
Full-time scientists and engineers	148.8	98.2	33.8	16.8
Engineers	18.0	13.2	3.8	.9
Physical scientists	33.6	26.5	6.4	.7
Chemists	9.8	7.3	2.3	.2
Earth scientists	3.5	2.7	.7	.1
Physicists	8.1	5.9	2.0	.1
Mathematicians	10.9	10.0	.8	.2
Other physical scientists	1.3	.7	.6	.1
Life scientists	62.8	29.3	20.5	13.0
Agricultural scientists	13.4	2.9	5.3	5.2
Biological scientists	20.6	12.7	7.1	.7
Medical scientists	28.8	13.7	8.1	7.1
Psychologists	7.0	5.7	.9	.4
Social scientists	26.5	22.9	2.2	1.4
Other scientists	.9	.5		.4

TABLE A-16.—Continued

Employment status and field of science	Total	Teaching	R&D	Other activities
Part-time scientists and engineers	40.8	29.6	7.8	3.4
Engineers	3.9	3.3	.5	.1
Physical scientists	6.0	5.1	.8	.1
Chemists	1.2	.9	.2	[a]
Earth scientists	.6	.4	.2	[a]
Physicists	1.4	1.1	.2	[a]
Mathematicians	2.7	2.5	.2	[a]
Other physical scientists	.2	.1	.1	[a]
Life scientists	22.1	13.7	5.5	2.8
Agricultural scientists	1.0	.3	.4	.3
Biological scientists	3.6	2.2	1.3	.1
Medical scientists	17.4	11.2	3.8	2.4
Psychologists	2.5	1.9	.4	.1
Social scientists	6.1	5.4	.5	.2
Other scientists	.2	.1	[a]	[a]
Employed graduate students	60.4	30.6	28.3	1.6
Engineers	10.4	3.8	6.5	.1
Physical scientists	22.7	13.1	9.2	.5
Chemists	8.4	4.8	3.4	.2
Earth scientists	2.2	1.2	.9	.1
Physicists	6.5	3.0	3.4	.1
Mathematicians	5.0	4.0	1.0	.1
Other physical scientists	.7	.2	.5	[a]
Life scientists	15.8	6.4	8.9	.5
Agricultural scientists	4.0	.7	3.2	.1
Biological scientists	8.7	4.5	4.0	.2
Medical scientists	3.2	1.2	1.7	.2
Psychologists	3.3	1.8	1.3	.2
Social scientists	8.1	5.4	2.4	.4
Other scientists	.1	[a]	.1	[a]

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[a] Fewer than 0.05(50).

TABLE A–17.—*Scientists and engineers employed in universities and colleges, by geographic location, January 1965*

(Thousands)

Geographic region and division	Total	Institutions granting graduate degrees in the sciences and engineering [a]	Other institutions	Selected components of graduate institutions	
				Medical schools	Agricultural schools and experiment stations
United States, total	250.0	210.2	39.8	51.1	22.4
Northeast	69.9	59.1	10.7	18.4	2.1
New England	20.7	17.6	3.1	3.7	1.1
Middle Atlantic	49.1	41.5	7.6	14.7	1.0
North Central	70.5	59.4	10.5	13.0	7.1
East North Central	47.7	40.2	7.0	8.2	3.7
West North Central	22.8	19.2	3.5	4.8	3.4
South	60.7	49.7	11.0	12.4	8.7
South Atlantic	30.7	24.6	6.1	7.6	3.8
East South Central	10.7	8.5	2.1	2.0	1.6
West South Central	19.4	16.6	2.8	2.9	3.3
West	47.4	39.9	7.5	6.5	4.3
Mountain	12.2	11.1	1.1	1.3	1.9
Pacific	35.2	28.8	6.4	5.2	2.5
U.S. territories	1.5	1.4	.1	.6	.2

[a] Includes medical schools and agricultural experiment stations.

TABLE A-18.—*Geographic distribution of scientists and engineers employed in universities and colleges, by employment status, January 1965*

(Thousands)

Geographic location	Total	Full time	Part time	Employed graduate students
UNITED STATES, TOTAL	250.0	148.8	40.8	60.4
NORTHEAST	69.9	38.1	16.7	15.1
New England	20.7	11.9	3.4	5.5
Maine	.8	.6	[a]	.1
New Hampshire	1.1	.8	.1	.3
Vermont	1.0	.7	.2	.1
Massachusetts	12.6	6.8	2.2	3.6
Rhode Island	1.4	.8	.1	.5
Connecticut	3.9	2.3	.8	.8
Middle Atlantic	49.1	26.2	13.3	9.6
New York	28.5	15.6	7.7	5.2
New Jersey	5.0	2.9	.9	1.2
Pennsylvania	15.6	7.6	4.7	3.2
NORTH CENTRAL	70.5	40.6	9.6	20.3
East North Central	47.7	26.6	7.3	13.8
Ohio	11.9	7.2	2.0	2.7
Indiana	6.4	3.5	.3	2.6
Illinois	12.8	6.9	2.2	3.7
Michigan	10.6	6.0	1.7	2.9
Wisconsin	6.1	3.1	1.0	2.0
West North Central	22.8	13.9	2.3	6.5
Minnesota	5.5	3.0	.6	1.9
Iowa	5.1	3.3	.5	1.4
Missouri	4.7	2.8	.7	1.2
North Dakota	.7	.5	[a]	.1
South Dakota	.8	.6	[a]	.2
Nebraska	1.9	1.2	.2	.5
Kansas	4.0	2.6	.3	1.2
SOUTH	60.7	40.8	6.8	13.1
South Atlantic	30.7	20.3	4.0	6.4
Maryland	6.1	3.7	1.1	1.2
District of Columbia	3.2	1.6	1.0	.6
Virginia	3.1	2.3	.3	.5
West Virginia	1.5	1.0	.1	.3
North Carolina	5.3	3.6	.4	1.3
South Carolina	1.8	1.2	.3	.4
Georgia	3.9	3.1	.3	.6
Florida	5.0	3.4	.5	1.1
East South Central	10.7	7.6	1.1	1.9
Kentucky	2.5	1.8	.2	.4
Tennessee	4.2	2.9	.5	.8
Alabama	2.0	1.4	.3	.3
Mississippi	1.9	1.5	.1	.3
West South Central	19.4	12.9	1.6	4.9
Arkansas	1.6	1.3	.1	.3
Louisiana	4.0	2.7	.4	.9
Oklahoma	3.2	1.9	.2	1.1
Texas	10.5	7.0	.9	2.6
WEST	47.4	28.2	7.6	11.6
Mountain	12.2	8.1	.7	3.3
Montana	1.0	.7	.1	.2
Idaho	.8	.6	[a]	.1
Wyoming	.4	.3	[a]	.1
Colorado	3.6	2.6	.1	.9
New Mexico	1.3	.8	.1	.4
Arizona	2.4	1.3	.1	1.0
Utah	2.3	1.5	.2	.6
Nevada	.4	.3	[a]	.1
Pacific	35.2	20.0	6.9	8.3
Washington	4.8	3.0	.4	1.4
Oregon	3.4	2.2	.2	.9
California	26.0	14.1	6.2	5.7
Alaska	.3	.2	[a]	.1
Hawaii	.8	.5	[a]	.2
U.S. territories	1.5	1.1	.1	.3

[a] Fewer than 0.05 (50).

TABLE A-19.—*Geographic distribution of scientists and engineers employed in universities and colleges, by broad field of science, January 1965*

(Thousands)

Geographic location	Total	Engineers	Physical scientists	Life scientists	Psychologists	Social scientists	Other scientists
UNITED STATES, TOTAL	250.0	32.4	62.4	100.7	12.7	40.7	1.1
NORTHEAST	69.9	9.3	17.8	28.3	3.6	10.7	.1
New England	20.7	3.3	5.8	7.3	1.0	3.3	[a]
Maine	.8	.1	.2	.2	[a]	.2	—
New Hampshire	1.1	.1	.3	.4	[a]	.2	—
Vermont	1.0	[a]	.2	.5	[a]	.2	[a]
Massachusetts	12.6	2.3	3.6	4.7	.5	1.5	[a]
Rhode Island	1.4	.2	.5	.3	.1	.3	[a]
Connecticut	3.9	.5	1.1	1.1	.3	.9	[a]
Middle Atlantic	49.1	6.0	12.0	21.0	2.6	7.5	.1
New York	28.5	3.4	6.9	12.2	1.5	4.4	.1
New Jersey	5.0	.9	1.6	1.4	.3	.9	[a]
Pennsylvania	15.6	1.8	3.5	7.4	.8	2.2	[a]
NORTH CENTRAL	70.5	9.6	17.3	27.5	3.7	11.8	.7
East North Central	47.7	7.2	12.3	17.1	2.7	8.1	.5
Ohio	11.9	1.5	2.7	5.2	.6	1.8	[a]
Indiana	6.4	1.0	2.0	1.7	.3	1.4	[a]
Illinois	12.8	1.9	3.6	4.6	.8	2.0	[a]
Michigan	10.6	2.2	2.4	3.2	.7	1.7	.4
Wisconsin	6.1	.6	1.6	2.5	.3	1.1	[a]
West North Central	22.8	2.4	5.0	10.5	1.0	3.7	.2
Minnesota	5.5	.5	1.1	2.7	.3	.9	[a]
Iowa	5.1	.5	1.0	2.5	.1	.7	.1
Missouri	4.7	.6	1.1	1.9	.2	.9	[a]
North Dakota	.7	.1	.2	.3	[a]	.1	[a]
South Dakota	.8	.1	.2	.3	[a]	.2	[a]
Nebraska	1.9	.2	.4	1.0	.1	.3	—
Kansas	4.0	.4	1.0	1.8	.2	.7	[a]
SOUTH	60.7	6.7	14.6	26.8	2.6	10.0	.3
South Atlantic	30.7	3.1	7.2	14.1	1.3	4.8	.1
Delaware	.8	.2	.2	.2	[a]	.1	—
Maryland	6.1	.4	1.5	3.2	.2	.8	[a]
District of Columbia	3.2	.2	.7	1.5	.1	.6	[a]
Virginia	3.1	.4	.8	1.2	.1	.6	[a]
West Virginia	1.5	.2	.3	.7	.1	.6	[a]
North Carolina	5.3	.5	1.2	2.5	.3	.2	[a]
South Carolina	1.8	.2	.5	.9	.1	.9	—
Georgia	3.9	.5	.7	2.0	.1	.3	[a]
Florida	5.0	.6	1.4	2.0	.3	.8	[a]
East South Central	10.7	1.1	2.3	4.7	.6	1.8	.1
Kentucky	2.5	.1	.5	1.1	.1	.5	[a]
Tennessee	4.2	.4	.9	2.1	.2	.6	[a]
Alabama	2.0	.4	.6	.7	.1	.4	[a]
Mississippi	1.9	.2	.4	.8	.1	.4	[a]
West South Central	19.4	2.4	5.0	7.9	.7	3.1	.1
Arkansas	1.6	.1	.3	.9	[a]	.2	[a]
Louisiana	4.0	.3	.9	2.1	.1	.6	[a]
Oklahoma	3.2	.6	.8	1.2	.1	.4	[a]
Texas	10.5	1.4	3.0	3.8	.5	1.9	[a]
WEST	47.4	6.7	12.4	17.2	2.8	8.1	.1
Mountain	12.2	2.0	3.3	4.5	.7	1.7	[a]
Montana	1.0	.1	.2	.4	[a]	.2	[a]
Idaho	.8	.1	.2	.4	[a]	.1	—
Wyoming	.4	.1	.1	.2	[a]	.1	—
Colorado	3.6	.6	.9	1.4	.2	.5	[a]
New Mexico	1.3	.3	.5	.3	.1	.1	[a]
Arizona	2.4	.4	.7	.8	.1	.4	[a]
Utah	2.3	.4	.6	.9	.2	.3	—
Nevada	.4	[a]	.1	.2	[a]	.1	—
Pacific	35.2	4.7	9.1	12.7	2.1	6.5	[a]
Washington	4.8	.5	1.1	2.1	.2	.7	[a]
Oregon	3.4	.2	1.0	1.5	.2	.5	[a]
California	26.0	3.9	6.6	8.6	1.7	5.1	[a]
Alaska	.3	[a]	.1	.1	[a]	[a]	—
Hawaii	.8	[a]	.2	.4	[a]	.1	—
U.S. territories	1.5	.1	.2	.9	[a]	.3	—

[a] Fewer than 0.05 (50).

TABLE A-20.—*Geographic distribution of full-time-equivalent scientists and engineers employed in universities and colleges, by function, January 1965*

(Thousands)

Geographic location	Total	Teaching	R&D	Other activities
UNITED STATES, TOTAL	192.6	117.7	54.9	19.9
NORTHEAST	51.2	32.4	15.5	3.3
New England	15.8	9.5	5.6	.6
Maine	.7	.5	.1	.1
New Hampshire	.9	.5	.4	[a]
Vermont	.8	.5	.2	.1
Massachusetts	9.4	5.8	3.4	.2
Rhode Island	1.1	.7	.3	.1
Connecticut	2.9	1.6	1.2	.1
Middle Atlantic	35.4	22.8	9.8	2.7
New York	21.0	13.6	5.9	1.4
New Jersey	3.9	2.5	1.2	.3
Pennsylvania	10.5	6.8	2.7	1.0
NORTH CENTRAL	54.3	32.7	15.2	6.4
East North Central	36.4	21.9	10.7	3.7
Ohio	9.2	5.8	1.9	1.5
Indiana	4.9	3.4	1.4	.1
Illinois	9.6	5.2	3.5	1.0
Michigan	8.1	4.7	2.7	.7
Wisconsin	4.5	2.9	1.2	.4
West North Central	18.0	10.8	4.5	2.7
Minnesota	4.2	2.5	1.3	.4
Iowa	4.1	2.1	1.0	1.0
Missouri	3.7	2.5	.9	.3
North Dakota	.6	.4	.1	[a]
South Dakota	.7	.5	.1	[a]
Nebraska	1.5	.9	.4	.2
Kansas	3.1	1.8	.7	.7
SOUTH	49.5	30.0	12.7	6.8
South Atlantic	24.6	14.7	6.9	3.1
Delaware	.6	.3	.2	[a]
Maryland	4.6	2.5	1.5	.6
District of Columbia	2.1	1.2	.6	.2
Virginia	2.7	1.9	.6	.2
West Virginia	1.3	.8	.3	.1
North Carolina	4.4	2.8	1.2	.4
South Carolina	1.4	.9	.2	.3
Georgia	3.4	1.8	.9	.7
Florida	4.2	2.3	1.3	.5
East South Central	9.0	6.0	1.8	1.2
Kentucky	2.1	1.3	.5	.4
Tennessee	3.4	2.3	.5	.6
Alabama	1.8	1.4	.3	[a]
Mississippi	1.7	1.0	.5	.1
West South Central	15.8	9.3	4.0	2.5
Arkansas	1.4	.7	.4	.4
Louisiana	3.3	2.1	.7	.5
Oklahoma	2.5	1.5	.6	.4
Texas	8.6	5.0	2.3	1.2
WEST	36.3	22.0	11.0	3.3
Mountain	10.2	5.5	3.3	1.3
Montana	.8	.4	.2	.2
Idaho	.7	.4	.3	[a]
Wyoming	.3	.2	.1	[a]
Colorado	3.1	1.9	.6	.6
New Mexico	1.1	.5	.5	[a]
Arizona	1.8	.9	.7	.2
Utah	2.1	1.0	.8	.3
Nevada	.3	.2	.1	.1
Pacific	26.1	16.4	7.7	2.0
Washington	3.8	2.2	.8	.7
Oregon	2.8	1.6	.9	.3
California	18.7	12.2	5.6	.9
Alaska	.2	.1	.1	[a]
Hawaii	.6	.3	.3	.1
U.S. territories	1.3	.7	.5	.1

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[a] Fewer than 0.05 (50).

TABLE A-21.—*Technicians employed in universities and colleges granting graduate degrees, by function and broad field of science, January 1965*

(Thousands)

Function and field of science	Institutions granting graduate degrees in—				
	Total	Sciences and engineering	Other	Medical schools	Agricultural schools and experiment stations
All functions	38.3	37.9	0.5	18.2	3.8
Engineering and physical sciences	8.3	8.1	.2	.2	.1
Life sciences	25.4	25.2	.2	17.0	3.5
Social sciences	1.2	1.1	[a]	[a]	.1
Other sciences	3.5	3.5	[a]	1.0	.1
Research and development	27.6	27.4	.2	12.9	3.1
Engineering and physical sciences	6.5	6.3	.1	.1	.1
Life sciences	18.2	18.2	.1	12.3	2.8
Social sciences	.9	.9	[a]	[a]	.1
Other sciences	2.0	2.0	[a]	.5	.1
Other activities	10.7	10.5	.3	5.3	.7
Engineering and physical sciences	1.8	1.7	.1	[a]	[a]
Life sciences	7.1	7.0	.1	4.7	.7
Social sciences	.2	.2	[a]	[a]	[a]
Other sciences	1.6	1.5	[a]	.5	[a]

[a] Fewer than 0.05(50).

TABLE A-22.—*Geographic location of technicians employed in universities and colleges granting graduate degrees, by broad field of science, January 1965*

(Thousands)

Geographic location	Total	Engineering & physical sciences	Life sciences	Social sciences	Other sciences
UNITED STATES, TOTAL	38.3	8.3	25.4	1.2	3.5
NORTHEAST	10.2	2.4	7.2	.3	.3
New England	3.0	1.0	1.8	.1	[a]
Maine	.1	[a]	[a]	[a]	---
New Hampshire	.1	[a]	.1	[a]	---
Vermont	[a]	[a]	[a]	---	---
Massachusetts	2.1	.7	1.3	.1	[a]
Rhode Island	.1	.1	.1	[a]	[a]
Connecticut	.6	.2	.3	[a]	---
Middle Atlantic	7.1	1.4	5.4	.2	.2
New York	4.5	.8	3.4	.2	.2
New Jersey	.7	.2	.4	[a]	.1
Pennsylvania	2.0	.4	1.6	[a]	[a]
NORTH CENTRAL	10.4	2.0	7.1	.4	.8
East North Central	6.8	1.6	4.3	.4	.6
Ohio	1.7	.5	1.1	.1	[a]
Indiana	1.4	.4	.7	.1	.2
Illinois	1.5	.4	.9	[a]	.1
Michigan	1.0	.3	.6	[a]	.1
Wisconsin	1.3	.1	1.1	[a]	.1
West North Central	3.5	.4	2.8	[a]	.2
Minnesota	1.5	.2	1.2	[a]	[a]
Iowa	.4	[a]	.4	---	[a]
Missouri	.8	.1	.6	[a]	.2
North Dakota	[a]	[a]	[a]	[a]	[a]
South Dakota	[a]	[a]	[a]	---	---
Nebraska	.5	[a]	.4	---	---
Kansas	.3	[a]	.2	---	[a]
SOUTH	9.0	1.7	6.7	.3	.3
South Atlantic	4.3	.8	3.3	.1	.2
Delaware	[a]	[a]	[a]	---	---
Maryland	.8	.1	.6	[a]	[a]
District of Columbia	.4	.1	.3	[a]	[a]
Virginia	0.5	0.1	0.4	[a]	[a]
West Virginia	.1	[a]	.1	[a]	[a]
North Carolina	.9	.2	.7	[a]	[a]
South Carolina	.2	[a]	.1	---	[a]
Georgia	.5	.1	.3	[a]	.1
Florida	.9	.2	.7	[a]	[a]
East South Central	1.9	.2	1.5	.1	.1
Kentucky	.5	[a]	.4	[a]	[a]
Tennessee	.8	.1	.6	.1	[a]
Alabama	.3	[a]	.3	---	[a]
Mississippi	.3	[a]	.2	[a]	---
West South Central	2.8	.7	1.9	.1	.1
Arkansas	.6	[a]	.5	---	[a]
Louisiana	.3	[a]	.2	---	[a]
Oklahoma	.3	.1	.2	[a]	[a]
Texas	1.6	.5	1.0	.1	[a]
WEST	8.8	2.2	4.3	.2	2.1
Mountain	1.7	.6	.9	.1	.2
Montana	.2	[a]	.1	[a]	[a]
Idaho	.1	[a]	[a]	---	[a]
Wyoming	.3	[a]	.3	[a]	[a]
Colorado	.6	.2	3.	[a]	.1
New Mexico	.2	.2	[a]	[a]	[a]
Arizona	.1	[a]	.1	[a]	[a]
Utah	.1	.1	[a]	---	---
Nevada	.1	[a]	[a]	[a]	[a]
Pacific	7.1	1.6	3.5	.1	1.9
Washington	.6	.1	.6	[a]	[a]
Oregon	.3	[a]	.2	---	.1
California	6.0	1.4	2.7	.1	1.8
Alaska	.1	[a]	[a]	---	---
Hawaii	[a]	[a]	[a]	---	[a]
U.S. territories	.3	.3	---	---	---

[a] Fewer than 0.05 (50).

TABLE A-23.—*Current expenditures for separately budgeted research and development in medical schools, by geographic location and source of funds, 1964*

(Millions of dollars)

Geographic region and division	Total	Federal Government	State and local governments	Foundations and voluntary health agencies	All other sources
United States, total	$351.1	$284.0	$11.5	$29.5	$26.0
Northeast	118.1	93.1	6.7	9.9	8.5
New England	28.8	25.4	.2	2.1	1.0
Middle Atlantic	89.4	67.6	6.5	7.8	7.5
North Central	86.9	69.8	2.0	8.0	7.0
East North Central	60.8	48.3	1.7	5.6	5.2
West North Central	26.1	21.5	.4	2.4	1.8
South	91.4	74.3	1.6	7.9	7.8
South Atlantic	47.8	38.1	.9	5.0	4.0
East South Central	15.1	13.1	.3	.9	.8
West South Central	28.4	23.1	.4	2.0	2.9
West	52.7	45.0	1.1	3.8	2.7
Mountain	8.7	7.9	.1	.5	.1
Pacific	44.0	37.1	1.1	3.3	2.5
U.S. territories	1.9	1.8	----------	[a]	[a]

[a] Less than $50,000.

TABLE A-24.—*Scientists employed in medical schools, by employment status and function, January 1965*

(Thousands)

Employment status	Total	Teaching	R&D	Other activities
Total	51.1	25.1	16.7	9.2
Full time	30.9	13.6	10.4	6.9
Part time	16.0	9.8	4.1	2.2
Employed graduate students	4.2	1.7	2.3	.2

TABLE A–25.—*Scientists employed in medical schools, by broad field of science and function, January 1965*

(Thousands)

Field of science	Total	Teaching	R&D	Other activities
Total	51.1	25.1	16.7	9.2
Engineers	[a]	----------	[a]	[a]
Physical scientists	.2	[a]	.2	[a]
Life scientists	50.4	24.9	16.3	9.2
Agricultural scientists	[a]	----------	[a]	----------
Biological scientists	8.8	4.3	4.2	.3
Medical scientists	41.5	20.6	12.1	8.8
Psychologists	.3	.1	.2	[a]
Social scientists	.1	[a]	[a]	[a]

[a] Fewer than 0.05 (50).

TABLE A–26.—*Scientists employed in medical schools, by geographic location and employment status, January 1965*

(Thousands)

Geographic region and division	Total	Full time	Part time	Employed graduate students
United States, total	51.1	30.9	16.0	4.2
Northeast	18.4	8.3	9.0	1.2
New England	3.7	2.0	1.4	.4
Middle Atlantic	14.7	6.3	7.6	.8
North Central	13.0	8.8	2.8	1.4
East North Central	8.2	5.2	2.3	.7
West North Central	4.8	3.5	.6	.7
South	12.5	8.7	2.5	1.2
South Atlantic	7.6	5.3	1.7	.7
East South Central	2.0	1.4	.4	.1
West South Central	2.9	2.0	.5	.4
West	6.5	4.6	1.6	.4
Mountain	1.3	1.2	.1	[a]
Pacific	5.2	3.4	1.5	.4
U.S. territories	.6	.6	.1	----------

[a] Fewer than 0.05 (50).

TABLE A–27.—*Full-time-equivalent scientists employed in medical schools, by geographic location and function, January 1965*

(Thousands)

Geographic region and division	Total	Teaching	R&D	Other activities
United States, total	38.2	16.1	14.1	8.0
Northeast	11.8	5.9	4.6	1.2
New England	2.6	1.8	.7	.1
Middle Atlantic	9.2	4.1	4.0	1.1
North Central	10.6	3.9	3.5	3.1
East North Central	6.4	2.7	2.2	1.5
West North Central	4.2	1.2	1.4	1.6
South	10.2	4.2	4.0	2.0
South Atlantic	6.2	2.4	2.3	1.4
East South Central	1.7	.9	.5	.2
West South Central	2.3	.9	1.1	.3
West	5.1	1.7	1.7	1.7
Mountain	1.2	.4	.3	.6
Pacific	3.9	1.3	1.4	1.2
U.S. territories	.6	.3	.3	[a]

[a] Fewer than 0.05 (50).

TABLE A–28.—*Current expenditures for separately budgeted research and development in agricultural experiment stations, by geographic location and source of funds, 1964*

(Millions of dollars)

Geographic region and division	Total	Federal Government	State and local governments	Other sources
United States, total	$208.7	$71.0	$117.1	$20.6
Northeast	25.1	8.5	14.3	2.4
New England	8.8	3.7	4.9	.2
Middle Atlantic	16.3	4.8	9.4	2.1
North Central	59.7	23.5	30.3	5.9
East North Central	31.4	13.2	14.9	3.3
West North Central	28.4	10.4	15.3	2.7
South	67.9	22.2	38.2	7.6
South Atlantic	29.9	9.6	15.5	4.8
East South Central	19.2	7.5	11.1	.7
West South Central	18.8	5.1	11.6	2.1
West	53.1	15.9	32.7	4.4
Mountain	19.2	6.1	11.3	1.8
Pacific	33.9	9.8	21.4	2.7
U.S. territories	2.9	.9	1.6	.4

Table A–29.—*Scientists and engineers employed in agricultural experiment stations, by geographic location and employment status, January 1965*

(Thousands)

Geographic region and division	Total	Full time	Part time	Employed graduate students
United States, total	22.4	15.8	1.2	5.4
Northeast	2.1	1.5	[a]	.6
New England	1.1	.8	[a]	.2
Middle Atlantic	1.0	.6	[a]	.3
North Central	7.1	3.8	.8	2.6
East North Central	3.7	1.7	.5	1.5
West North Central	3.4	2.0	.3	1.1
South	8.7	7.3	.2	1.2
South Atlantic	3.8	2.9	.2	.7
East South Central	1.6	1.4	[a]	.1
West South Central	3.3	2.9	[a]	.4
West	4.3	3.2	.2	1.0
Mountain	1.9	1.5	[a]	.4
Pacific	2.5	1.7	.2	.6
U.S. territories	.2	.1	----------	[a]

[a] Fewer than 0.05 (50).

Table A–30.—*Full-time-equivalent scientists and engineers employed in agricultural experiment stations, by geographic location and function, January 1965*

(Thousands)

Geographic region and division	Total	Teaching	R&D	Other activities
United States, total	19.0	3.5	9.4	6.1
Northeast	1.8	.4	.8	.6
New England	1.0	.2	.5	.2
Middle Atlantic	.8	.2	.3	.3
North Central	5.4	1.4	2.8	1.2
East North Central	2.7	.8	1.4	.5
West North Central	2.7	.6	1.4	.6
South	7.9	1.0	3.0	3.9
South Atlantic	3.3	.5	1.7	1.2
East South Central	1.5	.2	.5	.8
West South Central	3.1	.3	.9	1.9
West	3.7	.7	2.6	.4
Mountain	1.7	.3	1.0	.3
Pacific	2.1	.4	1.6	.1
U.S. territories	.2	[a]	.1	[a]

[a] Fewer than 0.05 (50).

TABLE A–31.—*Federally financed current expenditures for separately budgeted research and development in university-administered Federally Funded Research and Development Centers, by Federal agency and type of control, 1964*

(Millions of dollars)

Federal agency	Total	Public	Private	Consortia
Total	$629.2	$250.6	$320.4	$58.2
Atomic Energy Commission	365.5	237.2	86.6	41.7
Department of Agriculture	[a]	[a]	---	---
Department of Defense	146.5	12.7	133.7	---
Department of Health, Education, and Welfare	.2	.2	---	---
National Aeronautics and Space Administration	100.5	.4	100.1	---
National Science Foundation	16.5	---	---	16.5

[a] Less than $50,000.

TABLE A–32.—*Expenditures and employment for scientific activities in university-administered Federally Funded Research and Development Centers, by field of science, 1964 and 1965*

(Millions of dollars)

Field of science	Current expenditures for separately budgeted research, 1964	Capital expenditures for research, development, and instruction in the sciences and engineering, 1964	Scientists and engineers, January 1965 (thousands)
Total	$392.8	$146.9	11.7
Engineering	39.4	16.6	5.1
Physical sciences	316.4	123.5	5.7
Chemistry	45.6	[a]	[a]
Earth sciences	20.0	[a]	[a]
Physics	202.7	[a]	[a]
Mathematics	18.8	[a]	[a]
Other physical sciences	29.3	[a]	[a]
Life sciences	31.2	6.8	.7
Agricultural sciences	1.0	[a]	[a]
Biological sciences	22.8	[a]	[a]
Medical sciences	7.5	[a]	[a]
Psychology	4.3	[b]	.1
Social sciences	1.5	[b]	.1

[a] Data not requested in survey.

[b] Less than $50,000.

APPENDIX B

Federally Funded Research and Development Centers Administered by Universities and University Consortia[1]

Department of Defense

Department of the Army
- Army Mathematics Center (University of Wisconsin)
- Human Resources Research Office (George Washington University)
- Special Operations Research Office (American University)

Department of the Navy
- Applied Physics Laboratory (Johns Hopkins University)
- Applied Physics Laboratory (University of Washington)
- Arctic Research Laboratory (University of Alaska)
- Hudson Laboratories (Columbia University)
- Naval Biological Laboratory (University of California)
- Ordnance Research Laboratory (Pennsylvania State University)

Department of the Air Force
- Air Force Shock Tube Facility (University of New Mexico)
- Instrumentation Laboratory (Massachusetts Institute of Technology)
- Lincoln Laboratory (Massachusetts Institute of Technology)

Atomic Energy Commission

- Agricultural Research Laboratory (University of Tennessee)
- Ames Laboratory (Iowa State University of Science and Technology)
- Argonne Cancer Research Hospital (University of Chicago Medical School)
- Argonne National Laboratory (University of Chicago)
- Biomedical Project (University of California at Davis)
- Biomedical Project (University of California at Los Angeles)
- Biomedical Project (University of Rochester)
- Biomedical Project (University of Utah)
- Brookhaven National Laboratory (Associated Universities, Inc.)
- Cambridge Electron Accelerator (Harvard University and Massachusetts Institute of Technology)
- Lawrence Radiation Laboratory (University of California at Berkeley)
- Lawrence Radiation Laboratory (University of California at Livermore Division)
- Los Alamos Scientific Laboratory (University of California)

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[1] All of the organizations listed here except the Puerto Rico Nuclear Center were designated as FFRDC's by administering Federal agencies in academic year 1963–64. The Puerto Rico Nuclear Center was identified as an FFRDC by the administering institution, the University of Puerto Rico. For the latest available published list of such organizations, see National Science Foundation, *Federal Funds for Research, Development, and Other Scientific Activities, Fiscal Years 1966, 1967, and 1968*, Vol. XVI, NSF–67–19. Washington, D.C. 20402: Supt. of Documents, U.S. Government Printing Office, August 1967, pp. 93–94.

Oak Ridge Institute of Nuclear Studies (Oak Ridge Associated Universities, Inc.)
Princeton-Pennsylvania Proton Accelerator (Princeton University and University of Pennsylvania)
Princeton Stellerator (Princeton University)
Puerto Rico Nuclear Center (University of Puerto Rico)
Radiological Laboratory (University of California Medical Radiation Center)
Stanford Linear Accelerator Laboratory (Stanford University)

National Aeronautics and Space Administration

Jet Propulsion Laboratory (California Institute of Technology)
Laboratories for Applied Science (University of Chicago)

National Science Foundation

Kitt Peak National Observatory (Association of Universities for Research in Astronomy, Inc.)
National Center for Atmospheric Research (University Corp. for Atmospheric Research)
National Radio Astronomy Observatory (Associated Universities, Inc.)

Members of the university consortia that administer 5 of the 36 FFRDC's listed above are as follows:

Associated Universities, Inc.
Columbia University
Cornell University
Harvard University
Johns Hopkins University
Massachusetts Institute of Technology
University of Pennsylvania
Princeton University
University of Rochester
Yale University

Association of Universities for Research in Astronomy, Inc.
University of California
University of Chicago
Harvard University
Indiana University
University of Michigan
Ohio State University
Princeton University
University of Texas
University of Wisconsin
Yale University

University Corporation for Atmospheric Research
University of Alaska
University of Arizona
University of California
University of Chicago
Colorado State University
University of Colorado
Cornell University
Florida State University
University of Hawaii
Johns Hopkins University
Massachusetts Institute of Technology
University of Michigan
University of Minnesota
New York University
Pennsylvania State University
St. Louis University
Texas A & M University
University of Texas
University of Utah
University of Washington
University of Wisconsin

Oak Ridge Associated Universities
University of Alabama
University of Arkansas
Auburn University
Catholic University of America
Clemson University
Duke University
Emory University
Fisk University
University of Florida
Florida State University
University of Georgia
Georgia Institute of Technology
University of Kentucky
Louisiana State University
University of Louisville
University of Maryland
Medical College of Virginia
Meharry Medical College
University of Miami
University of Mississippi
Mississippi State University
University of North Carolina
North Carolina State University
North Texas State University
University of Oklahoma
University of Puerto Rico
Rice University
University of South Carolina
Southern Methodist University
University of Tennessee
University of Texas
Texas A & M University
Texas Christian University
Texas Woman's University
Tulane University
Tuskegee Institute
Vanderbilt University
University of Virginia
Virginia Polytechnic Institute
West Virginia University

APPENDIX C

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Covering Letter -- 68

NSF Form 9D–7a[1]—Used to collect data from 636 institutions that grant graduate degrees ------------------------------------ 70

Instructions for NSF Form 9D–7a -------------------------- 76

NSF Form 9D–7c—Used to collect data from 1,306 liberal arts and junior colleges, and other institutions that do not grant graduate degrees -- 87

Instructions for NSF Form 9D–7c -------------------------- 90

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[1] NSF Form 9D–7b which was used to collect separate data for agricultural experiment stations, medical schools, and Federally Funded Research and Development Centers, is not shown here. Information requested on this questionnaire was identical to that obtained on NSF Form 9D–7a.

NATIONAL SCIENCE FOUNDATION
OFFICE OF THE DIRECTOR
WASHINGTON 25, D.C.

February 12, 1965

Dear President:

The National Science Foundation requests your cooperation in its Survey of Scientific Activities of Institutions of Higher Education, 1963-64. The survey requests information on expenditures for research, development, and instruction in the sciences and engineering and on the employment of scientific and engineering personnel. Such data are needed by the National Science Foundation, other Federal agencies, and private organizations concerned with fostering scientific advancement in the United States.

As you know, the National Science Foundation is charged with statutory responsibilities for the support of basic research and education in the sciences and engineering. The Foundation also is responsible for obtaining factual information (on behalf of all interested groups in the Federal Government) which is related to the formulation of recommendations of national science policy. To meet these responsibilities, the Foundation needs information on magnitude and direction of the Nation's scientific effort. Data on the current allocations of scientific and engineering resources, by field of science, source of financing, geographical area, and type of institution are important to all those concerned with decision-making in the sciences and engineering, including private groups, state and local governments, and legislative as well as executive bodies. Information on such resources in institutions of higher education is particularly important, for such institutions bear responsibility not only for the education of the Nation's scientists and engineers, but also for the performance of a major part of the Nation's basic research.

This survey of institutions of higher education is part of the Foundation's survey program that also covers the scientific activities of industry, the Federal Government, and other nonprofit organizations. Data from such surveys are used to develop time series on financial and manpower resources allocated to science and engineering for particular sectors and for the economy as a whole, to analyze the impact of present programs, and to project resource requirements for the future.

In planning this and earlier surveys, the National Science Foundation has had the assistance and advice of fiscal and administrative officers from educational institutions throughout the country. In addition, other Federal agencies with a vital interest in the data to be derived from the survey have assisted in the development of the questionnaire.

Data collected in the survey will be used for statistical purposes only, and will not be published in any way that will disclose the information supplied by individual respondents. A copy of the final report on the survey will be furnished to you upon request. The published report on the survey will afford you the opportunity to compare the scientific and engineering resources of your institution with those of other institutions of comparable size, type, and geographical location, since summaries and averages for various institutional groupings will be provided.

In order that any future inquiries by the National Science Foundation regarding the survey may be directed to the official designated to complete the questionnaire for your institution, a self-addressed postcard for the entry of his name and title is enclosed. The early return of the postcard to the National Science Foundation will be appreciated.

If any questions arise regarding the interpretation of the survey questionnaire, please write or call Joseph H. Schuster (Area Code 202, 343-7783) at the Foundation's Office of Economic and Manpower Studies.

We are very grateful for your past assistance in similar matters and will greatly appreciate your help in the present survey. Needless to say, we regret the trouble and inconvenience that you will experience, but we believe that effective efforts of this sort are in the common interest.

Sincerely yours,

Leland J. Haworth

Leland J. Haworth
Director

Enclosures

NSF FORM
JAN 1965 9D-7a

Budget Bureau No. 99-R215
Approval expires September 1, 1965

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

SURVEY OF SCIENTIFIC ACTIVITIES OF INSTITUTIONS OF HIGHER EDUCATION, 1963-64

Name and address of Institution:

All completed forms and correspondence covering this survey should be addressed to:

Colleges and Universities Studies Group
National Science Foundation
Washington, D.C. 20550

The survey questionnaire is divided into two Parts. Part I requests financial data on current expenditures for separately budgeted research and development (R&D) and selected aspects of education in the sciences (including departmental research); and capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction. Part II requests data on employed professional personnel in science and engineering.

Please read the enclosed instructions before completing this form. Where exact data are not available, estimates are acceptable. Enter "none," "not available," or "not applicable," where appropriate, rather than leave an item blank. Each institution receiving this form is requested to complete the original copy and return it in the enclosed self-addressed envelope to the National Science Foundation within 60 days.

The information requested will be used for statistical purposes only, and will not be published in any way that will permit the identification of data of individual institutions.

In addition to completing this questionnaire for the institution as a whole, a limited number of institutions are requested to report data for certain of their organizational units. Separate blue questionnaires (NSF Form 9D-7b) should be used to report data for the following organizational units:

Federal contract research centers, as designated by Federal agencies
Schools of agriculture, including agricultural experiment stations and
  agricultural extension services
Schools of medicine

If your institution has separately organized units as defined on page 2 of the Instructions and has not received the appropriate forms, such forms will be furnished upon request.

This survey is intended to relate to the United States and its Territories. Exclude financial and personnel data related specifically to scientific activities carried out by organizational units of the institution located abroad.

Although Form 9D-7a is intended to be used to report data for the institution as a whole, it is recognized that some institutions may find it convenient to submit separate reports for branches or other organizational units. If your institution prefers to submit separate reports for branches or other organizational units rather than a single report covering the entire institution, list below all branches or other organizational units of your institution which have been excluded from this report and for which separate reports are being submitted:

PART I—FINANCIAL DATA

(Includes items 1 to 11 of the survey questionnaire)

Financial data reported in Part I are for the fiscal year which began on July 1, 1963 and ended on June 30, 1964, or your institution's equivalent fiscal year. Specify the ending date if different than above:

....

SECTION A

CURRENT EXPENDITURES FOR SEPARATELY BUDGETED RESEARCH AND DEVELOPMENT (R&D)

Item 1. Current expenditures for separately budgeted research and development, by source of funds and type of R&D activity, 1963-64

SOURCE OF FUNDS	THOUSANDS OF DOLLARS			
	TOTAL (1)	BASIC RESEARCH (2)	APPLIED RESEARCH (3)	DEVELOPMENT (4)
a. Federal Government	$	$	$	$
b. State and local governments				
c. Foundations and voluntary health agencies				
d. Industry				
e. Institution's own funds				
f. Other sources				
g. Total *(sum of a to f)*	$	$	$	$

Item 2. Current expenditures for separately budgeted research and development, by major cost item and source of funds, 1963-64

COST ITEM	THOUSANDS OF DOLLARS			
		SOURCE OF FUNDS		
			NON-FEDERAL ORGANIZATIONS	
	TOTAL (1)	FEDERAL GOVERNMENT (2)	INSTITUTION'S OWN FUNDS (3)	OTHER SOURCES (4)
a. Direct salaries and wages	$	$	$	$
b. All other direct costs (including materials and supplies)				
c. Sum of a and b	$	$	$	$
d. Indirect costs reimbursed or reimbursable	$	$	■	$
e. Total *(sum of c and d)*	$	$	$	$

Item 3. Indirect cost reimbursement for R&D activities sponsored by Federal and non-Federal organizations, 1963-64

a. Did the reimbursed or reimbursable indirect costs reported in item 2d cover the total indirect costs incurred in the performance of:

(1) R&D financed by the Federal Government? ☐ YES ☐ NO

(2) R&D financed by non-Federal organizations, excluding institution's own funds? ☐ YES ☐ NO

b. If "No" in a(1) above, estimate the amount of the institution's own funds that were used to defray the indirect costs incurred in the performance of R&D projects sponsored by the Federal Government.

THOUSANDS OF DOLLARS: $

c. If "No" in a(2) above, estimate the amount of the institution's own funds that were used to defray the indirect cost incurred in the performance of R&D projects financed by non-Federal sponsors.

THOUSANDS OF DOLLARS: $

Item 4. Federally financed current expenditures for separately budgeted research and development, by Federal agency, 1963-64

FEDERAL AGENCY	THOUSANDS OF DOLLARS
a. Atomic Energy Commission	$
b. Department of Agriculture	
c. Department of Defense:	
(1) Department of the Army	$
(2) Department of the Navy	
(3) Department of the Air Force	
(4) Other Department of Defense	
(5) Sum of (1) to (4)	$
d. Department of Health, Education, and Welfare	
e. National Aeronautics and Space Administration	
f. National Science Foundation	
g. Other Federal agencies	
h. Total *(sum of a to g)*	$

Item 5. Current expenditures for separately budgeted *basic and applied research,* by field of science and source of funds, 1963-64

FIELD OF SCIENCE	THOUSANDS OF DOLLARS		
	TOTAL (1)	SOURCE OF FUNDS	
		FEDERAL GOVERNMENT (2)	NON-FEDERAL ORGANIZATIONS INCLUDING THE REPORTING INSTITUTION (3)
a. Engineering	$	$	$
b. Physical sciences:			
(1) Chemistry	$	$	$
(2) Earth sciences			
(3) Physics			
(4) Mathematics			
(5) Other physical sciences			
(6) Sum of (1) to (5)	$	$	$
c. Life sciences:			
(1) Agricultural sciences	$	$	$
(2) Biological sciences			
(3) Medical sciences			
(4) Sum of (1) to (3)	$	$	$
d. Psychology			
e. Social sciences			
f. Other sciences (specify):			
______________			
______________			
______________			
g. Total *(sum of a to f)*	$	$	$

SECTION B
CAPITAL EXPENDITURES FOR SCIENTIFIC AND ENGINEERING FACILITIES AND EQUIPMENT FOR RESEARCH, DEVELOPMENT, AND INSTRUCTION

Item 6. Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by source of funds, purpose, and field of science, 1963-64

[Prorate any expenditures intended for use in two or more fields of science and for R&D and graduate and undergraduate instruction. Do not include any materials and supplies reported under current expenditures in Section A.]

SOURCE OF FUNDS AND PURPOSE	THOUSANDS OF DOLLARS					
	TOTAL (1)	ENGINEERING (2)	PHYSICAL SCIENCES (3)	LIFE SCIENCES (4)	SOCIAL SCIENCES (5)	OTHER SCIENCES* (6)
a. Federal sources:						
(1) R&D and graduate instruction	$	$	$	$	$	$
(2) Undergraduate instruction						
(3) Sum of (1) and (2)	$	$	$	$	$	$
b. Non-Federal sources:						
(1) R&D and graduate instruction	$	$	$	$	$	$
(2) Undergraduate instruction						
(3) Sum of (1) and (2)	$	$	$	$	$	$
c. All sources:						
(1) R&D and graduate instruction *(sum of a(1) and b(1))*	$	$	$	$	$	$
(2) Undergraduate instruction *(sum of a(2) and b(2))*						
(3) Total	$	$	$	$	$	$

*Include psychology in "Other sciences."

Item 7. Federal sources of capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by Federal agency, 1963-64

FEDERAL AGENCY	THOUSANDS OF DOLLARS		
	TOTAL (1)	R&D AND GRADUATE INSTRUCTION (2)	UNDERGRADUATE INSTRUCTION (3)
a. Atomic Energy Commission	$	$	$
b. Department of Agriculture			
c. Department of Defense			
d. Department of Health, Education, and Welfare			
e. National Aeronautics and Space Administration			
f. National Science Foundation			
g. Other Federal agencies			
h. Total *(sum of a to g)*	$	$	$

SECTION C

SELECTED CURRENT EXPENDITURES FOR EDUCATION IN THE SCIENCES AND ENGINEERING

Item 8. Current expenditures for instruction and departmental research in the sciences and engineering, by field of science, 1963-64

FIELD OF SCIENCE	TOTAL INSTRUCTION AND DEPARTMENTAL RESEARCH *(thousands of dollars)* (1)	DEPARTMENTAL RESEARCH AS A PERCENT OF TOTAL INSTRUCTION AND DEPARTMENTAL RESEARCH *(percent)* (2)
a. Engineering	$	%
b. Physical sciences		
c. Life sciences		
d. Psychology		
e. Social sciences		
f. Other sciences		
g. Total *(sum of a to f)*	$	

Item 9. Estimate the dollar amount of overhead (or indirect) costs allocable to the instruction and departmental research activities reported above *(item 8g column 1)*

THOUSANDS OF DOLLARS

$

Item 10. Current expenditures for separately budgeted projects for curriculum and course content improvement, by field of science, 1963-64

FIELD OF SCIENCE	THOUSANDS OF DOLLARS
a. Engineering	$
b. Physical sciences:	
(1) Mathematics	$
(2) Other physical sciences	
(3) Sum of (1) and (2)	$
c. Life sciences	
d. Psychology	
e. Social sciences	
f. Other sciences	
g. Total *(sum of a to f)*	$

Item 11. Current expenditures from restricted funds for instruction and departmental research in the sciences and engineering and separately budgeted projects for curriculum and course content improvement, by source of restricted funds, 1963-64

SOURCE OF RESTRICTED FUNDS	THOUSANDS OF DOLLARS	
	TOTAL INSTRUCTION AND DEPARTMENTAL RESEARCH (1)	SEPARATELY BUDGETED PROJECTS FOR CURRICULUM AND COURSE CONTENT IMPROVEMENT (2)
a. Federal sources:		
(1) Atomic Energy Commission	$	$
(2) Department of Agriculture		
(3) Department of Defense		
(4) Department of Health, Education, and Welfare		
(5) National Aeronautics and Space Administration		
(6) National Science Foundation		
(7) Other Federal agencies		
(8) Sum of (1) to (7)	$	$
b. State government		
c. Local governments		
d. Foundations and voluntary health agencies		
e. Industry		
f. Other restricted funds		
g. Total *(sum of a to f)*	$	$

PART II—PERSONNEL DATA

(Includes items 12 to 17 of the survey questionnaire)

Personnel data in Part II are to be reported as of January 1965, or as close as possible thereto, except for item 16 in which data for January 1964 are also requested.

SECTION D—NUMBER OF PROFESSIONAL PERSONNEL EMPLOYED IN SCIENCE AND ENGINEERING

Item 12. Number of full-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965

FIELD OF EMPLOYMENT	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Engineers:				
(1) Aeronautical engineers				
(2) Chemical engineers				
(3) Civil engineers				
(4) Electrical engineers				
(5) Mechanical engineers				
(6) Industrial engineers				
(7) Other engineers				
(8) Sum of (1) to (7)				
b. Physical scientists:				
(1) Chemists				
(2) Earth scientists				
(3) Physicists				
(4) Mathematicians				
(5) Other physical scientists				
(6) Sum of (1) to (5)				
c. Life scientists:				
(1) Agricultural scientists				
(2) Biological scientists				
(3) Medical scientists				
(4) Sum of (1) to (3)				
d. Psychologists				
e. Social scientists:				
(1) Economists				
(2) Sociologists				
(3) Political scientists				
(4) Other social scientists				
(5) Sum of (1) to (4)				
f. Other scientists (specify):				
g. Total *(sum of a to f)*				

Item 13. Number of part-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965

FIELD OF EMPLOYMENT	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Engineers:				
(1) Aeronautical engineers				
(2) Chemical engineers				
(3) Civil engineers				
(4) Electrical engineers				
(5) Mechanical engineers				
(6) Industrial engineers				
(7) Other engineers				
(8) Sum of (1) to (7)				
b. Physical scientists:				
(1) Chemists				
(2) Earth scientists				
(3) Physicists				
(4) Mathematicians				
(5) Other physical scientists				
(6) Sum of (1) to (5)				
c. Life scientists:				
(1) Agricultural scientists				
(2) Biological scientists				
(3) Medical scientists				
(4) Sum of (1) to (3)				
d. Psychologists				
e. Social scientists:				
(1) Economists				
(2) Sociologists				
(3) Political scientists				
(4) Other social scientists				
(5) Sum of (1) to (4)				
f. Other scientists (specify):				
g. Total *(sum of a to f)*				

Item 14. Number of graduate students employed part-time as scientists and engineers, by field and function in which primarily employed, January 1965

FIELD OF EMPLOYMENT	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Engineers:				
(1) Aeronautical engineers				
(2) Chemical engineers				
(3) Civil engineers				
(4) Electrical engineers				
(5) Mechanical engineers				
(6) Industrial engineers				
(7) Other engineers				
(8) Sum of (1) to (7)				
b. Physical scientists:				
(1) Chemists				
(2) Earth scientists				
(3) Physicists				
(4) Mathematicians				
(5) Other physical scientists				
(6) Sum of (1) to (5)				
c. Life scientists:				
(1) Agricultural scientists				
(2) Biological scientists				
(3) Medical scientists				
(4) Sum of (1) to (3)				
d. Psychologists				
e. Social scientists:				
(1) Economists				
(2) Sociologists				
(3) Political scientists				
(4) Other social scientists				
(5) Sum of (1) to (4)				
f. Other scientists (specify):				
g. Total *(sum of a to f)*				

Item 15. Distribution of professional personnel and graduate students employed in scientific and engineering activities in terms of full-time equivalents (FTE), by type of personnel and function, January 1965

TYPE OF PERSONNEL	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Full-time scientists and engineers*				
b. Part-time scientists and engineers				
c. Employed graduate students				
d. Total *(sum of a to c)*				

*Note that total reported in Item 15a, column 1 should be the same as the total of Item 12g column 1. However, the distribution among the functions (columns 2, 3, and 4) will not necessarily coincide with the functional distribution on a "primarily employed" basis (Item 12g).

SECTION E—NUMBER OF PROFESSIONAL PERSONNEL EMPLOYED IN ALL ACTIVITIES AND NUMBER OF TECHNICIANS EMPLOYED IN SCIENCE AND ENGINEERING

Item 16. Number of full-time and part-time professional personnel employed in all activities, January 1964 and January 1965

TYPE OF PERSONNEL	NUMBER EMPLOYED	
	JANUARY 1964	JANUARY 1965
a. Scientists and engineers (full and part-time)		
b. Other professional personnel (full and part-time)		
c. Graduate students employed part-time as scientists and engineers		
d. Total *(sum of a to c)*		

Item 17. Number of employed technicians, by field and function in which primarily employed, January 1965

FIELD OF EMPLOYMENT	TOTAL (1)	R&D (2)	OTHER ACTIVITIES (3)
a. Engineering and physical science technicians			
b. Life science technicians			
c. Social science technicians			
d. Other technicians			
e. Total *(sum of a to d)*			

REMARKS: (If additional space is needed, attach an extra page)

NAME AND ADDRESS OF PERSON SUBMITTING THIS FORM:

NAME OF PERSON	TITLE
NAME OF INSTITUTION	ADDRESS *(number, street, city, state, ZIP code)*
TELEPHONE NO. / DATE	

NSF Forms 9D-7a and 9D-7b
Instruction Sheet

NATIONAL SCIENCE FOUNDATION
Washington, D. C. 20550

INSTRUCTIONS FOR SURVEY OF SCIENTIFIC ACTIVITIES OF INSTITUTIONS OF HIGHER EDUCATION, 1963–64

OUTLINE OF INSTRUCTIONS

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GENERAL

The National Science Foundation requests your cooperation in completing the attached questionnaire covering the financial and manpower characteristics of your institution as they relate to science and engineering.

The purpose of this survey is to obtain statistical data on the resources devoted to scientific activities at institutions of higher education. This information will assist the National Science Foundation to fulfill its responsibilities in supporting basic research and education in the sciences and in the formulation of recommendations on national science policy in keeping with the National Science Foundation Act of 1950 and Executive Order No. 10521 of March 17, 1954.

Each institution included in this survey is requested to supply data on the total current expenditures for separately budgeted (i.e., organized) research and development (R&D) and selected current expenditures for education in the sciences and engineering (including departmental research); capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction; and employed scientific and engineering professional personnel. Because information on some items may not be available from records normally maintained by colleges and universities, reasonable estimates for such items will be satisfactory. Enter "none," "not available," or "not applicable," where appropriate, rather than leave an item blank.

If you have any questions regarding information requested on this form, write to Colleges and Universities Studies Group, National Science Foundation, Washington, D.C., 20550. Additional forms may be obtained by writing to the above address.

PERIOD COVERED BY THE REPORT

The time period covered in the financial sections of the form (Part I) is the fiscal year which began on July 1, 1963 and ended on June 30, 1964, or your institution's equivalent fiscal year ending in 1964.

Personnel data (Part II) are to be reported as of mid-January 1965 (the payroll period containing January 12, 1965), or as close thereto as possible.

REPORTING UNITS

This survey covers research, development, and other scientific activities of all branches and other units of the parent institution, both on or off the main campus, in the United States and its Territories. Research centers administered by universities for the Federal Government are to be included.

Every institution should complete a white form presenting aggregate data for the entire institution (NSF Form 9D-7a). If data are requested for one or more units of an institution, blue forms (NSF Form 9D-7b) will be attached with the names of the units concerned entered on them. The blue form should be completed for only that part of the institution which is specified on the form. If your institution has not received forms for all such units as described in the instructions below, additional forms will be supplied upon request.

For purposes of this survey, the various organizational units of colleges and universities for which a blue questionnaire (NSF Form 9D-7b) is requested are defined as follows:

Federal contract research centers, as designated by Federal agencies, are R&D organizations exclusively or substantially financed by the Government, which are administered on a contractual basis by educational institutions or other organizations.

Schools of agriculture, including agricultural experiment stations and agricultural extension services include all agricultural experiment stations and their branch stations established under the provisions of the Hatch Act of 1887; schools of agriculture in land-grant institutions that are affiliated with experiment stations; and agricultural extension services established under the provisions of the Smith-Lever Act of 1914.

Medical schools are those two- or four-year schools of medicine approved by the Council on Medical Education and Hospitals and the Association of American Medical Colleges. Included are hospitals or clinics owned, operated, or controlled by universities and integrated operationally with the clinical programs of their medical schools. Also included are research bureaus or institutes which are integral parts of medical schools. In addition, include those research bureaus and institutes which are non-university owned but are affiliated with the institution and any university bureaus and institutes which may be outside the departmental structure of universities but whose senior research staff members hold teaching appointments with medical schools.

Alternative Reporting Procedure—Although NSF Form 9D-7a is intended to be used to report data for the institution as a whole, it is recognized that some institutions may find it convenient to submit separate reports for branches or other organizational units. If your institution prefers to submit separate reports for branches or other organizational units rather than a single report covering the entire institution, list in the space provided on the first page of NSF Form 9D-7a, all branches or other organizational units of your institution which have been excluded from NSF Form 9D-7a and for which separate reports are being submitted. This procedure may be used in the case of separate organizational units for which separate data have been provided on NSF Form 9D-7b.

DEFINITION OF RESEARCH AND DEVELOPMENT (R&D)

Research and development include basic and applied research in the sciences and in engineering, and design and development of prototypes and processes.

Research is systematic, intensive study directed toward fuller knowledge of the subject studied. Research may be either basic or applied.

> *Basic research* is directed toward increase of knowledge; it is research where the primary aim of the investigator is a fuller knowledge or under-

standing of the subject under study rather than a practical application thereof.

Applied research is directed toward practical application of knowledge. The definition of applied research differs from the definition of basic research chiefly in terms of the objectives of the investigator.

Development is the systematic use of knowledge directed toward the design and production of useful prototypes, materials, devices, systems, methods, or processes. It does not include quality control or routine product testing.

CLASSIFICATION OF FIELDS OF SCIENCE

Listed below are selected disciplines included in engineering and various fields of science for which separate data are requested in items 5, 6, 8, and 10 in Part I of this questionnaire. Data on professional and other personnel requested in Part II of the questionnaire should also be based on this classification of fields of science.

Engineering:

- Aeronautical
- Chemical
- Civil
  - Architectural
  - Structural
  - Sanitary
- Electrical
- Mechanical
- Industrial
- Other engineering fields
  - Agricultural
  - Ceramic
  - Geological
  - Mineral
  - Mining
  - Nuclear
  - Petroleum
  - Textile
  - Other engineering

Physical sciences:

CHEMISTRY

- Agricultural and food chemistry
- Analytical chemistry
- Inorganic chemistry
- Organic chemistry
- Physical chemistry
- Physical organic chemistry
- Radiochemistry and isotope chemistry
- Theoretical chemistry
- Other chemistry

EARTH SCIENCES

- Climatology
- Geochemistry
- Geodesy and cartography
- Geography (physical)
- Geology
- Geophysics
- Hydrology and hydrography
- Meteorology
- Mineralogy
- Oceanography
- Petrography and petrology
- Seismology and volcanology
- Stratigraphy, geomorphology, and tectonophysics
- Terrestrial magnetism and electricity
- Other earth sciences

PHYSICS

- Acoustics
- Atomic and molecular physics
- Electromagnetic phenomena
- Electron physics and gaseous discharge
- Mechanics
- Nuclear physics and cosmic rays
- Optics
- Solid state physics
- Thermodynamics
- Other physics

MATHEMATICS

- Algebra and number theory
- Analysis
- Differential equations
- Functional analysis
- Mathematical logic and theory of sets
- Mathematical statistics
- Numerical analysis
- Theoretical mechanics
- Topology and geometry
- Other mathematics

OTHER PHYSICAL SCIENCES

- Astronomy
- Metallurgy
- Other physical sciences

Life sciences:

AGRICULTURAL SCIENCES

- Agronomy
- Animal husbandry
- Crops
- Dairy husbandry
- Fish and wildlife
- Food technology

Life sciences (continued)

- Forestry
- Horticulture
- Range management
- Soils
- Other agricultural sciences

BIOLOGICAL SCIENCES

- Anatomy
- Anthropology (physical)
- Bacteriology
- Biochemistry
- Biology
- Biometrics
- Biophysics
- Biostatistics
- Botany
- Entomology
- Genetics
- Microbiology
- Nutrition
- Paleontology
- Pathology
- Pharmacology
- Phytopathology
- Physiology
- Zoology
- Other biological sciences

MEDICAL SCIENCES

- Anesthesiology
- Cardiology
- Dermatology
- Dentistry
- Geriatrics
- Internal medicine
- Neurology
- Obstetrics and gynecology
- Ophthalmology
- Otolaryngology
- Pediatrics
- Pharmacy
- Physical medicine and rehabilitation
- Podiatry
- Psychiatry
- Public health
- Radiology
- Surgery
- Veterinary medicine
- Other clinical sciences

Psychology:

- Clinical psychology
- Experimental psychology
- Social psychology
- Other psychology

Social sciences:

The social sciences are concerned primarily with understanding the behavior of groups and individuals as members of groups. Included in the social sciences for purposes of this survey are:

- Economics (including agricultural economics, econometrics, and economic statistics)
- Sociology
- Political science
- Other social sciences
  - Anthropology (social)
  - Archeology
  - Geography (economic and social)
  - History
  - Other social sciences

Other sciences:

Other sciences which cannot be readily classified under one of the above named fields.

PART I—FINANCIAL DATA

(Includes items 1 to 11 of the survey questionnaire)

Section A—Current Expenditures for Separately Budgeted Research and Development (R&D)

In general, financial data requested in this survey are intended to be consistent with principles of financial accounting for institutions of higher education presented in *College and University Business Administration*, Vol. I (Washington, D.C.; American Council on Education, 1952). Similarly, data in this survey are related to financial data reported in U.S. Office of Education's survey, "Financial Statistics of Institutions of Higher Education" (Form OE-2000). It should be noted, however, that there are a few terminological and other differences between the present survey and the Office of Education survey cited above. For example, the present survey uses the term, "Research and Development," to denote the entire spectrum of separately budgeted R&D activities, as defined above, whereas the Office of Education survey uses the term, "Organized Research."

Item 1. Current expenditures for separately budgeted research and development, by source of funds and type of R&D activity, 1963–64.

Sources of funds refer to immediate sources rather than ultimate sources of funds concerned. For example, Federal funds which are received by your institution through *State* channels should be reported as *State* funds, and funds received by your institution from a *Foundation* should be reported under that source, even if industry was the original source of some or all of the foundation's funds. Under *Federal Government* (item 1a) include grants and contracts "earmarked" for research and development by all agencies of the Federal Government. Exclude R&D contracts subcontracted by your institution to be performed by other organizations.

Under *State and local governments* (item 1b) include funds designated or "earmarked" for R&D by State, municipal, or other local governments and their agencies.

Under *Foundations and voluntary health agencies* (item 1c) include grants and contracts earmarked for R&D by nonprofit philanthropic foundations and trusts or voluntary health agencies not affiliated with your institution, such as the Carnegie, Ford, Kresge or Rockefeller Foundations, the American Cancer Society, and the American Heart Association. Funds from foundations which are affiliated with, or grant solely to, your institution should be included under *Institution's own funds*. Funds specifically designated for R&D and derived from a health agency that is a unit of a State or local government should be reported under *State and local governments*.

Under *Industry (including trade associations)* (item 1d) include all grants and contracts earmarked for R&D by profit-making organizations, whether engaged in production, distribution, research, service, or other activities. Do not include grants and contracts from *nonprofit* foundations financed by industry, which should be reported under *Foundations and voluntary health agencies*.

Under *Institution's own funds* (item 1e) include any funds which the institution was free to designate for R&D and which were in fact so budgeted. The sources of these funds may include endowment income; tuition and fees; general-purpose State or local government appropriations; and general-purpose grants from industry, foundations, health agencies or other outside sources providing *unrestricted* funds which were utilized by your institution for separately budgeted R&D.

Under *Other sources* (item 1f) report any additional funds received from outside sources other than those already noted, and which were earmarked for R&D *by the source*. Examples include gifts, grants, or contracts received from private individuals or professional societies, and designated for R&D by them.

Types of R&D activity (basic research, applied research, and development) are defined on page 2. It is recognized that your records may not yield exact figures on amounts expended for basic research, applied research, and development. In such cases reasonable estimates will be satisfactory.

Item 2. Current expenditures for separately budgeted R&D, by major cost item and source of funds, 1963–64.

Provide a breakdown of the principal direct cost items, as follows: (a) direct salaries and wages, and (b) all other direct costs (including materials and supplies).

In item 2d, report the total reimbursed or reimbursable indirect costs received from R&D activities sponsored by Federal and non-Federal organizations. Total for 2e column 2 should equal figures reported in item 1a column 1, and item 2e columns 3 and 4 should equal the sum of items 1b to 1f column 1.

Item 3. Indirect cost reimbursement for R&D activities sponsored by Federal and non-Federal organizations, 1963-64.

The objective of this item is to obtain information on the extent to which allowable indirect costs were sufficient to compensate your institution for indirect costs incurred in the performance of separately budgeted R&D sponsored by outside organizations. In computing indirect costs incurred on separately budgeted R&D sponsored by outside organizations, utilize procedures and principles outlined in the U. S. Bureau of the Budget's Circular A-21, January 7, 1961; audited rates determined in accordance with Armed Services or other Federal Agency procurement regulations; or other procedures deemed appropriate by your institution.

If "No" in item 3a(1), indicate in item 3b the amount of your institution's own funds that was used to defray the indirect costs of Federally-sponsored R&D.

If "No" in item 3a(2), indicate in item 3c the amount of your institution's own funds that was used to defray the indirect costs of R&D work performed for non-Federal sponsors. Do not include here any indirect costs associated with performance of separately budgeted R&D projects financed with the institution's own funds.

Item 4. Federally financed current expenditures for separately budgeted research and development, by Federal agency, 1963–64.

Separate data are requested for six Federal agencies, as follows: (a) the Atomic Energy Commission; (b) the Department of Agriculture; (c) the Department of Defense (with detail for the Departments of the Army, Navy, and Air Force, and other Department of Defense); (d) the Department of Health, Education, and Welfare (including Public Health Service, National Institutes of Health, and Office of Education); (e) the National Aeronautics and Space Administration; and (f) the National Science Foundation. All other Federal agencies are to be reported in a single group (item 4g). Totals reported in items 4h and 1a column 1 should be equal.

Item 5. Current expenditures for separately budgeted basic and applied research, by field of science and source of funds, 1963–64.

In column 1, include all current expenditures for total separately budgeted research, by field of science, whether such expenditures derive from outside sources or your institution's own funds, and whether from contracts, grants, gifts, endowment (income or principal), State and local government appropriations, or other sources, provided the funds were separately budgeted for research and development and were expended in the fiscal year 1963–64. Also include any indirect costs reimbursed or reimbursable by outside sponsors of research projects. Where it is not possible to identify expenditures for the year, receipts may be substituted.

In column 2, classify total separately budgeted research financed by the Federal Government, by field of science. In column 3, provide such data for all non-Federal sources, including the institution's own funds.

Totals in item 5g column 1 should equal the sum of columns 2 and 3 in item 1g.

Section B—Capital Expenditures for Scientific and Engineering Facilities and Equipment for Research, Development, and Instruction

This section covers capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction during 1963–64. Report funds expended during 1963–64 for facilities which were in process in that year and for facilities which were completed that year. Expenditures for administration buildings, steam plants, residence halls, and other such facilities should be excluded unless utilized principally for research, development, or instruction in engineering or in the sciences. All land costs should be excluded.

Facilities and equipment expenditures include the following: (a) fixed equipment such as built-in equipment and furnishings (hoods, fixed laboratory tables and benches, and ventilation equipment); (b) movable scientific equipment such as oscilloscopes, pulse-height analyzers, spectrometers, and plasma and protein separators; (c) movable furnishings such as bookcases, desks, file cabinets, tables, and simple tools; (d) architect's fees, site work, extension of utilities, and the building costs of service functions such as integral cafeterias and bookstores of a facility; and (e) special separate facilities used to house scientific apparatus such as hypersonic tunnels, accelerators, and oceanographic vessels.

Item 6. Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by source of funds, purpose, and field of science, 1963–64.

Capital expenditures should be divided into two parts: (1) R&D and graduate instruction and (2) undergraduate instruction. Further, classify such expenditures by broad fields of science, as follows: engineering, and the physical, life, social, and other sciences (in this item only, psychology is to be included in other sciences). Report Federal sources of such funds in item 6a; non-Federal sources, including institution's own funds, in item 6b; and total all sources, in item 6c.

Prorate capital expenditures for multi-purpose structures. The space utilized for particular functions may be used as a guide in prorating. Thus, if 50 percent of the total square footage of a science building is allocated to R&D and graduate instruction, the remaining 50 percent to undergraduate instruction, then capital expenditures should be distributed accordingly between these two functions.

The following guidelines may be helpful in determining the functional usage of space: (1) Research and development (R&D) are described previously in the Instructions. Graduate instruction is a course of study which is given to or offered primarily for students who have attained a first-level degree and is designed to lead to a second level or doctoral degree in a given field. Included is post-doctoral education which is defined as advanced training beyond the Ph.D. or Sc.D. degree, as well as the training of interns and residents. (2) Undergraduate instruction is a course of study designed to lead to the first-level (Bachelor's or first professional) degree in a given field. Instruction of students enrolled in a medical school for the purpose of attaining the M.D. degree should be classified as undergraduate instruction.

Item 7. Federal sources of capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by Federal agency, 1963–64.

Prorate funds received from various Federal agencies between R&D and graduate instruction and undergraduate instruction. Totals reported in item 7h should agree with totals reported in item 6a column 1.

Section C–Selected Current Expenditures for Education in the Sciences and Engineering

Financial data requested in this section are intended to be consistent with data reported in U. S. Office of Education's survey "Financial Statistics of Institutions of Higher Education" (Form OE-2000). Data requested should be derived from or estimated on the basis of Current-Fund Income (Income for Educational and General Purposes) and Current-Fund Expenditures (Educational and General Expenditures). For example, data on expenditures for instruction and departmental research reported in this section should be consistent with data included in item 25 of Form OE-2000.

Current expenditures for instruction and departmental research include the salaries of department heads, faculty members, secretaries and technicians, office expenses and equipment, laboratory expenses and equipment, and other expenses. All expenditures incurred for instructional programs in science and engineering subjects for students pursuing degree-credit courses of study which lead generally to a certificate or degree should be included. In addition, data are requested on current expenditures for separately budgeted projects for curriculum and course content improvement.

Item 8. Current expenditures for instruction and departmental research in the sciences and engineering, by field of science, 1963–64.

Under total *instruction and departmental research* (column 1) report all current expenditures of the instructional departments, colleges, and schools of the institution in science and engineering, by field of science.

In column 2 percentage estimates for departmental research will be sufficient. It is recognized that the accounting systems of institutions of higher education may not yield an exact breakdown between expenditures for instruction and expenditures for departmental research. However, estimates of the proportion of faculty time devoted to departmental research may serve as a useful guideline in estimating the share of departmental expenditures allocable to departmental research.

Item 9. Estimate the dollar amount of overhead (or indirect) costs allocable to the instruction and departmental research activities reported above (item 8g column 1).

Current expenditures for instruction and departmental research in the sciences and engineering (item 8) represent *direct* expenditures incurred by your institution in carrying out these functions. The purpose of item 9 is to obtain an estimate of the overhead or indirect costs associated with these direct expenditures. Such overhead or indirect costs include an appropriate share of the institution's expenditures for general administration, student services, libraries, and the operation and maintenance of physical plant.

Item 10. Current expenditures for separately budgeted projects for curriculum and course content improvement, by field of science, 1963–64.

Separately budgeted projects for curriculum and course content improvement include qualitative studies or experimentation (and the evaluation thereof) conducted by individuals, study groups, panels, committees, and/or commissions in the general area of course content in science and teaching equipment and aids for science. Among the objectives of such projects are the following: the improvement of curricula in specific science fields; the development of prototypes of science books, science teachers' guides, and science laboratory manuals; the development of science movies or filmstrips of special merit for the teaching of science; and the development of prototypes of equipment for classroom and laboratory instruction.

Report current expenditures including reimbursed or reimbursable indirect costs. It is not intended that expenditures reported in this item duplicate any figures reported for separately budgeted research and development in Section A of this questionnaire. If amounts reported in this item involve any duplication of expenditures data reported in Section A, please report the dollar amount of such expenditures in the space provided for "Remarks" on the last page of the questionnaire.

Item 11. Current expenditures from restricted funds for instruction and departmental research in the sciences and engineering and separately budgeted projects for curriculum and course content improvement, by source of restricted funds, 1963–64.

Restricted funds include gifts, bequests, income from investment of endowments, and grants that are to be spent for the purpose designated by the donor. This item requests a breakdown of those expenditures reported in item 8g column 1 which came from restricted funds and separately budgeted projects for curriculum and course content improvement (item 10g), by source. Examples of restricted funds that might be used for instruction and departmental research are National Science Foundation, Institutional Grants; National Institutes of Health, General Research Support Grants; and National Aeronautics and Space Administration, Sustaining University Program. Student assistance in the form of payments to individuals such as scholarships, fellowships, and prizes should be excluded.

Sources of funds refer to immediate sources rather than ultimate sources of funds concerned. (See Instructions for item 1, Section A.)

PART II–PERSONNEL DATA

(Includes items 12 to 17 of the survey questionnaire)

Section D–Number of Professional Personnel Employed in Science and Engineering

This section requests data on scientific and engineering professional personnel employed or engaged in teaching, research and development, or other activities by all branches and other units of the parent institution, whether on or off the main campus, in the United States and its Territories. Professional personnel include salaried personnel of your institution who have received a Bachelor's degree or higher or, if foreign educated, academic training equal to a Bachelor's degree or higher, and who are working at a professional level (a level at which the knowledge acquired by such academic training is essential in the performance of duties). Report employed professional personnel who were paid a salary or stipend and also members of religious orders who received no remuneration while employed at the institution. Exclude voluntary personnel such as voluntary staff members at medical and dental schools. Report data for scientific and technical personnel employed as of mid-January 1965 (the payroll period containing January 12, 1965), or as close to that date as possible.

For the purposes of this survey, graduate students employed on a part-time basis as scientists and engineers by your institution should be reported in item 14. Include in item 14 all graduate students who devote part of their time to a course of study designed to lead to an advanced degree in the sciences or engineering and who also receive compensation from your institution for part-time professional services performed in the sciences or engineering. Exclude from item 14 any graduate students who hold full-time appointments as scientists or engineers in teaching, R&D, or other activities at your institution; they should be reported as full-time professional personnel in item 12.

The following instructions relate primarily to the reporting of professional personnel by those institutions with separate administrative units, for which NSF Form 9D-7b (blue questionnaire) will be prepared.

A. For *schools of agriculture, and affiliated agricultural experiment stations and agricultural extension services*, include data for professional personnel holding appointments at the station, those holding appointments at the associated school or college of agriculture, those holding appointments in the extension service, and those holding joint or multiple appointments.

B. For *medical schools* include data for all professional personnel with primary appointments in the school, but exclude unpaid voluntary staff. Include professional personnel employed by hospitals or clinics owned, operated, or controlled by the university and integrated operationally with the clinical programs of the medical school. Include residents employed in such hospitals or clinics, but exclude interns. Student health services are not to be included in the form for the medical school.

C. For *Federal contract research centers* include data for professional personnel holding appointments at the center. Personnel holding joint appointments in more than one organizational unit including a center are to be reported for the center only if they held their principal appointments with the center.

Item 12. Number of full-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965.

The reporting institution is requested to use its own definition of what constitutes a full-time appointment. Report the number of full-time professional personnel employed as of January 1965, or the nearest date during the academic year for which such data are available.

Report professional personnel in the field in which they are primarily employed by the institution. Personnel primarily engaged in administration or community service should be classified in the field most closely related to their present employment at the institution.

The functional classification of professional personnel, teaching (column 2), R&D (column 3), and other activities (column 4), should be based on the function in which the person is primarily engaged or employed at the institution. For example, a person engaged in two or all three of the specified functional categories should be classified in the function in which he spends the largest proportion of his time. In classifying personnel by function, take into account only activities carried out under the auspices or the official encouragement of your institution. Exclude outside consulting work and teaching not performed under the auspices of your institution.

In classifying an individual under a particular category (teaching, research and development, or other activities), take into consideration all official activities even if carried on in a school or department other than the one in which he holds his principal appointment.

Teaching (column 2) is defined as encompassing those activities connected with degree credit courses or which are intended to lead ultimately to the granting of degrees or certificates or to professional certification or licensing. Included are such functions as instruction and training performed in connection with degree credit courses and the administration of such instruction and training. Also include instruction of interns, residents, and other professional personnel receiving advanced training such as postdoctoral fellows and trainees.

The term, research and development (column 3), is defined on page 2 of these instructions. Included in this function is the preparation for publication of books and papers describing the results of the specific research and development, if carried out as an integral part of that research and development. Also included is the administration of research and development.

Under other activities (column 4) report all professional personnel not primarily employed in teaching or research and development, as defined above. Examples of such activities are agricultural demonstration work; adult education (if not degree credit); dissemination of scientific information; student health services; diagnosis and treatment of patients in offices, hospitals, clinics, and outpatient facilities; and general administration.

Item 13. Number of part-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965.

The reporting institution is requested to use its own definition of what constitutes part-time employment. Instructions for item 12 relating to field and classification by function (columns 2, 3, and 4) also relate to part-time professional employees in item 13.

Item 14. Number of graduate students employed part-time as scientists and engineers, by field and function in which primarily employed, January 1965.

Graduate students employed in science and engineering include those individuals who receive compensation from your institution for part-time services performed and meet the criteria for professional personnel. Do not include graduate students in science and engineering who hold full-time appointments in teaching, R&D, or other activities; they should be reported as full-time professional personnel in item 12.

Item 15. Distribution of professional personnel and graduate students employed in scientific and engineering activities in terms of full-time equivalents (FTE), by type of personnel and function, January 1965.

Classify personnel reported in items 12g, 13g, and 14g in each of the three functions on a full-time equivalent basis. Apportion time of staff members among the three functions on the basis of the proportion of time spent in each of the functions. For example, 24 individuals devoting three-fourths time to teaching and one-fourth to research and development should be reported as 18 in teaching and 6 in research and development. Calculate full-time equivalents to the nearest whole number. In item 15d, figures in columns 2, 3, and 4 should add to the total in column 1.

In estimating the full-time equivalents of part-time personnel use your institution's definition of such equivalents. Thus, four part-time instructors, each of whom teaches one 3-hour credit course, may be reported as one full-time equivalent in teaching, if four such credit courses were considered the load of a full-time instructor at the institution.

Section E—Number of Professional Personnel Employed in All Activities and Number of Technicians Employed in Science and Engineering

Item 16. Number of full-time and part-time professional personnel employed in all activities, January 1964 and January 1965.

Item 16a. Report data on the number of full-time and part-time professional personnel employed by the institution in science and engineering, as of January 1965 or the nearest date in the academic year in which such data are available; and also for January 1964.

It should be noted that the number of professional scientific and engineering personnel reported in item 16a for January 1965 should be the same as the combined total of items 12g column 1 and 13g column 1.

Professional personnel are defined to include all persons employed by the institution in positions requiring an educational background of at least the Bachelor's degree. Exclude personnel employed as technicians or employed in other occupations not requiring a Bachelor's degree or the equivalent.

Item 16b. Report data on the number of full-time and part-time professional personnel employed in all fields except science and engineering for January 1964 and January 1965.

Finally, in *item 16c* report the number of graduate students employed in science and engineering for January 1964 and January 1965. The number for January 1965 should be the same as the total reported for item 14g column 1.

In item 16c, under employed graduate students include those individuals who received compensation from your institution for services performed during 1964 and 1965 and who meet the criteria for professional personnel, as defined above. Do not include graduate students who hold full-time appointments; they should be classified as full-time professional personnel (item 16a).

Item 17. Number of employed technicians, by field and function in which primarily employed, January 1965.

Technicians include all persons employed in positions which involve technical work at a level requiring knowledge of engineering, mathematics, physical science, life science, or social science comparable to that acquired through formal post-high school training (less than a Bachelor's degree), such as that obtained at technical institutes and junior colleges or through equivalent on-the-job training or experience. Some typical job titles include laboratory technician or assistant, physical science aide, engineering aide, statistical aide, draftsman, and computer programmer.

Do not include those persons counted as employed graduate students. Such persons should be reported in item 16c. Also exclude craftsmen such as electricians, carpenters, machinists, etc. In the case where undergraduate students, juniors or seniors, are employed in R&D activities, they may, where applicable, be included as technicians.

NSF FORM 9D-7c
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NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

SURVEY OF SCIENTIFIC ACTIVITIES OF INSTITUTIONS OF HIGHER EDUCATION, 1963-64

All completed forms and correspondence covering this survey should be addressed to:

Colleges and Universities Studies Group
National Science Foundation
Washington, D.C. 20550

Name and address of institution

Data on current expenditures for separately budgeted research and development (R&D); capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction; employed professional personnel in science and engineering; and selected current expenditures for education in the sciences are requested in this survey.

Please read the enclosed instructions before completing this form. Where exact data are not available, estimates are acceptable. Enter "none," "not available," or "not applicable" where appropriate, rather than leave an item blank. Each institution receiving this form is requested to complete the original copy and return it in the enclosed self-addressed envelope to the National Science Foundation within 60 days.

The information requested will be used for statistical purposes only, and will not be published in any way that will permit the identification of data of individual institutions.

SECTION A
CURRENT EXPENDITURES FOR SEPARATELY BUDGETED RESEARCH AND DEVELOPMENT (R&D)

Item 1. Did your institution perform any separately budgeted research and development in 1963-64?

☐ YES ☐ NO

If "No," skip to Section B (Item 4).

Item 2. Current expenditures for separately budgeted research and development, by source of funds, 1963-64

	THOUSANDS OF DOLLARS
a. Federal sources:	
(1) Department of Defense	$
(2) Department of Health, Education, and Welfare	
(3) National Aeronautics and Space Administration	
(4) National Science Foundation	
(5) Other Federal agencies	
(6) Sum of (1) to (5)	$
b. Other sources, including institution's own funds	
c. Total *(sum of a and b)*	$

Item 3. Estimate the percentage of separately budgeted research and development expenditures for basic research .... ________%

SECTION B—CAPITAL EXPENDITURES FOR SCIENTIFIC AND ENGINEERING FACILITIES AND EQUIPMENT FOR RESEARCH, DEVELOPMENT, AND INSTRUCTION

Item 4. Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by field of science, 1963-64

FIELD OF SCIENCE	THOUSANDS OF DOLLARS
a. Engineering	$
b. Physical sciences	
c. Life sciences	
d. Social sciences	
e. Other sciences (include psychology)	
f. Total *(sum of a to e)* - same as Item 5c	$

Item 5. Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by source of funds, 1963-64

	THOUSANDS OF DOLLARS
a. Federal sources:	
(1) Department of Defense	$
(2) Department of Health, Education, and Welfare	
(3) National Aeronautics and Space Administration	
(4) National Science Foundation	
(5) Other Federal agencies	
(6) Sum of (1) to (5)	$
b. Other sources, including institution's own funds	
c. Total *(sum of a and b)* - same as Item 4f	$

SECTION C— SELECTED CURRENT EXPENDITURES FOR EDUCATION IN THE SCIENCES AND ENGINEERING

Item 6. Current expenditures for instruction and departmental research in the sciences and engineering, by field of science, 1963-64

FIELD OF SCIENCE	TOTAL INSTRUCTION AND DEPARTMENTAL RESEARCH *(thousands of dollars)* (1)	DEPARTMENTAL RESEARCH AS A PERCENT OF TOTAL INSTRUCTION AND DEPARTMENTAL RESEARCH *(percent)* (2)
a. Engineering	$	%
b. Physical sciences		
c. Life sciences		
d. Psychology		
e. Social sciences		
f. Other sciences		
g. Total *(sum of a to f)*	$	

Item 7. Estimate the dollar amount of overhead (or indirect) costs allocable to the instruction and departmental research activities reported above *(item 6g, column 1)*

THOUSANDS OF DOLLARS
$

Item 8. Current expenditures for separately budgeted projects for curriculum and course content improvement, by field of science, 1963-64

FIELD OF SCIENCE	THOUSANDS OF DOLLARS
a. Engineering	$
b. Physical sciences:	
(1) Mathematics	$
(2) Other physical sciences	
(3) Sum of (1) and (2)	$
c. Life sciences	
d. Psychology	
e. Social sciences	
f. Other sciences	
g. Total *(sum of a to f)*	$

Item 9. Current expenditures from restricted funds for instruction and departmental research in the sciences and engineering and separately budgeted projects for curriculum and course content improvement, by source of restricted funds, 1963-64

SOURCE OF RESTRICTED FUNDS	THOUSANDS OF DOLLARS	
	TOTAL INSTRUCTION AND DEPARTMENTAL RESEARCH (1)	SEPARATELY BUDGETED PROJECTS FOR CURRICULUM AND COURSE CONTENT IMPROVEMENT (2)
a. Federal sources:		
(1) Atomic Energy Commission	$	$
(2) Department of Agriculture		
(3) Department of Defense		
(4) Department of Health, Education, and Welfare		
(5) National Aeronautics and Space Administration		
(6) National Science Foundation		
(7) Other Federal agencies		
(8) Sum of (1) to (7)	$	$
b. State government		
c. Local governments		
d. Foundations and voluntary health agencies		
e. Industry		
f. Other restricted funds		
g. Total *(sum of a to f)*	$	$

SECTION D—NUMBER OF PROFESSIONAL PERSONNEL EMPLOYED IN SCIENCE AND ENGINEERING

Item 10. Number of full-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965

FIELD OF EMPLOYMENT	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Engineers				
b. Physical scientists				
c. Life scientists				
d. Psychologists				
e. Social scientists				
f. Other scientists				
g. Total *(sum of a to f)*				

Item 11. Number of part-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965

FIELD OF EMPLOYMENT	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Engineers				
b. Physical scientists				
c. Life scientists				
d. Psychologists				
e. Social scientists				
f. Other scientists				
g. Total *(sum of a to f)*				

Item 12. Distribution of professional personnel in scientific and engineering activities in terms of full-time equivalents (FTE), by type of personnel and function, January 1965

TYPE OF PERSONNEL	TOTAL (1)	TEACHING (2)	R&D (3)	OTHER ACTIVITIES (4)
a. Full-time scientists and engineers*				
b. Part-time scientists and engineers				
c. Total *(sum of a and b)*				

*Note that the total reported in Item 12a, column 1 should be the same as the total of Item 10g, column 1. However, the distribution among the functions (columns 2, 3, and 4) will not necessarily coincide with the functional distribution on a "primarily employed" basis (Item 10g).

SECTION E—NUMBER OF PROFESSIONAL PERSONNEL EMPLOYED IN ALL ACTIVITIES

Item 13. Number of full-time and part-time employed professional personnel in all activities, by field, January 1964 and January 1965

TYPE OF PERSONNEL	NUMBER EMPLOYED	
	JANUARY 1964	JANUARY 1965
a. Scientists and engineers (full and part-time)		
b. Other professional personnel (full and part-time)		
c. Total *(sum of a and b)*		

Remarks *(if additional space is needed, attach an extra page)*:

NAME AND ADDRESS OF PERSON SUBMITTING THIS FORM:

NAME OF PERSON	TITLE
NAME OF INSTITUTION	ADDRESS *(number, street, city, state, ZIP code)*
TELEPHONE NO. / DATE	

NSF Form 9D-7c
Instruction Sheet

NATIONAL SCIENCE FOUNDATION
Washington, D. C. 20550

INSTRUCTIONS FOR SURVEY OF SCIENTIFIC ACTIVITIES OF INSTITUTIONS OF HIGHER EDUCATION, 1963–64

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GENERAL

The National Science Foundation requests your cooperation in completing the attached questionnaire covering the financial and manpower characteristics of your institution as they relate to science and engineering.

The purpose of this survey is to obtain statistical data on the resources devoted to scientific activities at institutions of higher education. This information will assist the National Science Foundation to fulfill its responsibilities in supporting basic research and education in the sciences and in the formulation of recommendations on national science policy in keeping with the National Science Foundation Act of 1950 and Executive Order No. 10521 of March 17, 1954.

Each institution included in this survey should complete NSF Form 9D-7c which requests aggregate data on current expenditures for research and development (Section A); capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction (Section B); selected current expenditures for education in the sciences and engineering (including departmental research) (Section C); number of professional personnel employed in science and engineering (Section D); and number of professional personnel employed in all activities (Section E).

Because information on some items may not be available from records normally maintained by colleges and universities, reasonable estimates for such items will be satisfactory. Enter "none," "not available," or "not applicable," where appropriate, rather than leave an item blank.

If you have any questions regarding information requested on this form, write to Colleges and Universities Studies Group, National Science Foundation, Washington, D.C., 20550. Additional forms may be obtained by writing to the above address.

PERIOD COVERED BY THE REPORT

The time period covered in the financial sections of the form (Sections A, B, and C) is the fiscal year which began on July 1, 1963, and ended on June 30, 1964, or your institution's equivalent fiscal year ending in 1964.

Personnel data (Sections D and E) are to be reported as of mid-January 1965 (the payroll period containing January 12, 1965), or as close thereto as possible.

DEFINITION OF RESEARCH AND DEVELOPMENT (R&D)

Research and development include basic and applied research in the sciences and in engineering, and design and development of prototypes and processes.

Research is systematic, intensive study directed toward fuller knowledge of the subject studied. Research may be either basic or applied.

> *Basic research* is directed toward increase of knowledge; it is research where the primary aim of the investigator is a fuller knowledge or understanding of the subject under study rather than a practical application thereof.
>
> *Applied research* is directed toward practical application of knowledge. The definition of applied research differs from the definition of basic research chiefly in terms of the objectives of the investigator.

Development is the systematic use of knowledge directed toward the design and production of useful prototypes, materials, devices, systems, methods, or processes. It does not include quality control or routine product testing.

CLASSIFICATION OF FIELDS OF SCIENCE

Listed below are selected disciplines included in engineering and various fields of science for which separate data are requested in items 4, 6, 8, 10, and 11 of this questionnaire.

Engineering:

- Aeronautical
- Chemical
- Civil
  - Architectural
  - Structural
  - Sanitary
- Electrical
- Mechanical
- Industrial
- Other engineering fields
  - Agricultural
  - Ceramic
  - Geological
  - Mineral
  - Mining
  - Nuclear
  - Petroleum
  - Textile
  - Engineering-related technology
  - Other engineering

Physical sciences:

- CHEMISTRY
  - Agricultural and food chemistry
  - Analytical chemistry
  - Inorganic chemistry
  - Organic chemistry
  - Physical chemistry
  - Physical organic chemistry
  - Radiochemistry and isotope chemistry
  - Theoretical chemistry
  - Other chemistry
- EARTH SCIENCES
  - Climatology
  - Geochemistry
  - Geodesy and cartography
  - Geography (physical)
  - Geology
  - Geophysics
  - Hydrology and hydrography
  - Meteorology
  - Mineralogy
  - Oceanography
  - Petrography and petrology
  - Seismology and volcanology
  - Stratigraphy, geomorphology, and tectonophysics
  - Terrestrial magnetism and electricity
  - Other earth sciences

PHYSICS

- Acoustics
- Atomic and molecular physics
- Electromagnetic phenomena
- Electron physics and gaseous discharge
- Mechanics
- Nuclear physics and cosmic rays
- Optics
- Solid state physics
- Thermodynamics
- Other physics

MATHEMATICS

- Algebra and number theory
- Analysis
- Differential equations
- Functional analysis
- Mathematical logic and theory of sets
- Mathematical statistics
- Numerical analysis
- Theoretical mechanics
- Topology and geometry
- Other mathematics

OTHER PHYSICAL SCIENCES

- Astronomy
- Metallurgy
- Other physical sciences

Life sciences:

AGRICULTURAL SCIENCES

- Agronomy
- Animal husbandry
- Crops
- Dairy husbandry
- Fish and wildlife
- Food technology
- Forestry
- Horticulture
- Range management
- Soils
- Other agricultural sciences

BIOLOGICAL SCIENCES

- Anatomy
- Anthropology (physical)
- Bacteriology
- Biochemistry
- Biology
- Biometrics
- Biophysics
- Biostatistics
- Botany
- Entomology
- Genetics
- Microbiology
- Nutrition
- Paleontology
- Pathology
- Pharmacology
- Physiology
- Phytopathology
- Zoology
- Other biological sciences

MEDICAL SCIENCES

- Anesthesiology
- Cardiology
- Dermatology
- Dentistry
- Geriatrics
- Internal medicine
- Neurology
- Obstetrics and gynecology
- Ophthalmology
- Otolaryngology
- Pediatrics
- Pharmacy
- Physical medicine and rehabilitation
- Podiatry
- Psychiatry
- Public health
- Radiology
- Surgery
- Veterinary medicine
- Health-related technology
- Other clinical sciences

Psychology:

- Clinical psychology
- Experimental psychology
- Social psychology
- Other psychology

Social sciences:

The social sciences are concerned primarily with understanding the behavior of groups and individuals as members of groups. Included in the social sciences for purposes of this survey are:

- Economics (including agricultural economics, econometrics, and economic statistics)
- Business-related technology
- Sociology
- Political science
- Other social sciences
  - Anthropology (social)
  - Archeology
  - Geography (economic and social)
  - History
  - Other social sciences

Other sciences:

Other sciences which cannot be readily classified under one of the above named fields.

FINANCIAL DATA

Section A–Current Expenditures for Separately Budgeted Research and Development (R&D)

In general, financial data requested in this survey are intended to be consistent with principles of financial accounting for institutions of higher education presented in *College and University Business Administration*, Vol. I (Washington, D.C.; American Council on Education, 1952). Similarly, data in this survey should be considered in relation to financial data reported in U.S. Office of Education's survey, "Financial Statistics of Institutions of Higher Education" (Form OE-2000). It should be noted, however, that there are a few terminological and other differences between the present survey and the Office of Education survey cited above. For example, the present survey uses the term, "Research and Development," to denote the entire spectrum of separately budgeted R&D activities, as defined above, whereas the Office of Education survey uses the term, "Organized Research."

Item 2. Current expenditures for separately budgeted research and development, by source of funds, 1963–64.

In item 2a, report expenditures on federally financed R&D contracts and grants, by source of funds.

In item 2b, report expenditures for separately budgeted research and development financed by non-Federal organizations, including State, municipal, or local governments; foundations and voluntary health agencies; industry and trade organizations; institution's own funds; and gifts, grants, and contracts received from private individuals or professional societies.

Item 3. Estimate the percentage of separately budgeted research and development expenditures for basic research.

It is recognized that it may be extremely difficult for your institution to report basic research expenditures in absolute terms; if that should be the case, a reasonable estimate (on percentage basis) of total current operating R&D expenditures used for basic research will be satisfactory.

Section B–Capital Expenditures for Scientific and Engineering Facilities and Equipment for Research, Development, and Instruction

This Section covers capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction during 1963–64. Report funds expended during 1963–64 for facilities which were in process in that year, and for facilities which were completed in that year. Expenditures for administration buildings, steam plants, residence halls, and other such facilities should be excluded, unless utilized principally for research, development, or instruction in engineering or in the sciences. All land costs should be excluded.

Facilities and equipment expenditures include the following: (a) fixed equipment such as built-in equipment and furnishings (hoods, fixed laboratory tables and benches, and ventilation equipment); (b) movable scientific equipment such as oscilloscopes, pulse-height analyzers, spectrometers, and plasma and protein separators; (c) movable furnishings such as bookcases, desks, file cabinets, tables, and simple tools; (d) architect's fees, site work, extension of utilities, and the building costs of service functions such as integral cafeterias and bookstores of a facility; and (e) special separate facilities used to house scientific apparatus such as hypersonic tunnels, accelerators, and oceanographic vessels.

Item 4. Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by field of science, 1963–64.

Report data on capital expenditures classified by broad fields of science, as follows: (a) Engineering, (b) Physical sciences, (c) Life sciences,

(d) Social sciences, and (e) Other sciences (psychology is to be included in this category only in this item).

Item 5. Capital expenditures for scientific and engineering facilities and equipment for research, development, and instruction, by source of funds, 1963–64.

In item 5a, report federally financed capital expenditures by agency source.

In item 5b, report capital expenditures financed by non-Federal organizations, including State, municipal, or local governments; foundations and voluntary health agencies; industry and trade organizations; institution's own funds; and gifts, grants, and contracts received from private individuals or professional societies.

Section C–Selected Current Expenditures for Education in the Sciences and Engineering

Financial data requested in this section are intended to be consistent with data reported in U.S. Office of Education's survey "Financial Statistics of Institutions of Higher Education" (Form OE-2000). Data requested should be derived from or estimated on the basis of Current-Fund Income (Income for Educational and General Purposes) and Current-Fund Expenditures (Educational and General Expenditures). For example, data on expenditures for instruction and departmental research reported in this section should be consistent with data included in item 25 of Form OE-2000.

Current expenditures for instruction and departmental research include the salaries of department heads, faculty members, secretaries and technicians, office expenses and equipment, laboratory expenses and equipment, and other expenses. All expenditures incurred for instructional programs in science and engineering subjects for students pursuing degree-credit courses of study or which lead generally to a certificate or degree should be included. In addition, data are requested on current expenditures for separately budgeted projects for curriculum and course content improvement.

Item 6. Current expenditures for instruction and departmental research in the sciences and engineering, by field of science, 1963–64.

Under total *instruction and departmental research* (column 1) report all current expenditures of the instructional departments of the institution in the sciences and engineering, by field of science.

In column 2 percentage estimates for departmental research will be sufficient. It is recognized that the accounting systems of institutions of higher education may not yield an exact breakdown between expenditures for instruction and expenditures for departmental research. However, estimates of the proportion of faculty time devoted to departmental research may serve as a useful guideline in estimating the share of departmental expenditures allocable to departmental research.

Item 7. Estimate the dollar amount of overhead (or indirect) costs allocable to the instruction and departmental research activities reported above (item 6g column 1).

Current expenditures for instruction and departmental research in the sciences and engineering (item 6) represent *direct* expenditures incurred by your institution in carrying out these functions. The purpose of item 7 is to obtain an estimate of the overhead or indirect costs associated with these direct expenditures. Such overhead or indirect costs include an appropriate share of the institution's expenditures for general administration, student services, libraries, and the operation and maintenance of physical plant.

Item 8. Current expenditures for separately budgeted projects for curriculum and course content improvement, by field of science, 1963–64.

Separately budgeted projects for curriculum and course content improvement include qualitative studies or experimentation (and the evaluation thereof) conducted by individuals, study groups, panels, committees, and/or commissions in the general area of course content in science and teaching equipment and aids for science. Among the objectives of such projects are the following: the improvement of curricula in specific science fields; the development of prototypes of science books, science teachers' guides, and science laboratory manuals; the development of science movies or filmstrips of special merit for the teaching of science; and the development of prototypes of equipment for classroom and laboratory instruction.

Report current expenditures including reimbursed or reimbursable indirect costs. It is not intended that expenditures reported in this item duplicate any figures reported for separately budgeted research and development in Section A of this questionnaire. If amounts reported in this item involve any duplication of expenditures reported in Section A, please report the dollar amount of such expenditures in the space provided for "Remarks" on the last page of the questionnaire.

Item 9. Current expenditures from restricted funds for instruction and departmental research in the sciences and engineering and separately budgeted projects for curriculum and course content improvement, by source of restricted funds, 1963–64.

Restricted funds include gifts, bequests, income from the investment of endowments, and grants that are to be spent for the purpose designated by the donor. This item requests a breakdown, by source of funds, of restricted current expenditures for instruction and departmental research (item 6g column 1) and separately budgeted projects for curriculum and course content improvement (item 8g). Sources of funds refer to immediate sources rather than ultimate sources of funds concerned. For example, Federal funds which are received by your institution through *State* channels should be reported as *State* funds, and funds received by your institufrom a *Foundation* should be reported under that source, even if an industry was the original source of some or all of the foundation's funds. Examples of restricted funds that might be used for instruction and departmental research are National Science Foundation, Institutional Grants; National Institutes of Health, General Research Support Grants; and National Aeronautics and Space Administration, Sustaining University Program. Student assistance in the form of payments to individuals such as scholarships, fellowships, and prizes should be excluded.

PERSONNEL DATA

Section D—Number of Professional Personnel Employed in Science and Engineering

This Section requests data on professional personnel employed or engaged in teaching, research and development, or other activities of the reporting institution. Professional personnel include salaried personnel of your institution who have received a Bachelor's degree or higher or, if foreign educated, academic training equal to a Bachelor's degree, and who are working at a professional level requiring such academic training.

Report employed professional personnel who were paid a salary or stipend and also members of religious orders who received no remuneration while performing services at the institution. Exclude voluntary personnel such as voluntary staff members at medical and dental schools. Report data for scientific and technical personnel employed as of mid-January 1965 (the payroll period containing January 12, 1965), or as close to that date as possible.

Item 10. Number of full-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965.

The reporting institution is requested to use its own definition of what constitutes a full-time appointment. Report the number of full-time professional personnel employed as of mid-January 1965, or the nearest date during the academic year for which such data are available.

Report professional personnel in the field in which they are primarily employed by the institution. Personnel primarily engaged in administration or community service should be classified in the field most closely related to their present employment at the institution.

The functional classification of professional personnel, teaching (column 2), R&D (column 3), and other activities (column 4), should be based on the function in which the person is primarily engaged or employed at the institution. For example, a person engaged in two or all three of the specified functional categories should be classified in the function in which he spends the largest proportion of his time. In classifying personnel by function, take into account only activities carried out under the auspices or the official encouragement of your institution. Exclude outside consulting work and teaching not performed under the auspices of your institution.

In classifying an individual under a particular category (teaching, research and development, or other activities), take into consideration all official activities even if carried on in a school or department other than the one in which he holds his principal appointment.

Teaching (column 2) is defined as encompassing those activities connected with degree credit courses or which are intended to lead ultimately to the granting of degrees or certificates or to professional certification or licensing. Included are such functions as instruction and training performed in connection with degree credit courses and the administration of such instruction and training.

The term, research and development (column 3), is defined on page 2 of these instructions. Included in this function is the preparation for publication of books and papers describing the results of the specific research and development, if carried out as an integral part of that research and development. Also include the administration of research and development.

Under other activities (column 4) report all professional personnel not primarily employed in teaching or research and development, as defined above. Examples of such activities are agricultural demonstration work; adult education (if not degree credit); dissemination of scientific information; student health services; and general administration.

Item 11. Number of part-time scientific and engineering professional personnel, by field and function in which primarily employed, January 1965.

The reporting institution is requested to use its own definition of what constitutes part-time employment. Instructions for item 10 relating to field and classification by function (columns 2, 3, and 4) also relate to part-time professional employees.

Item 12. Distribution of professional personnel employed in scientific and engineering activities in terms of full-time equivalents (FTE), by type of personnel and function, January 1965.

Classify personnel reported in items 10g and 11g in each of the three functions on a full-time equivalent basis. Apportion time of staff members among the three functions on the basis of the proportion of time spent in each of the functions. For example, 24 individuals devoting three-fourths time to teaching and one-fourth to research and development should be reported as 18 in teaching and 6 in research and development. Calculate full-time equivalents to the nearest whole number. In item 12c figures in columns 2, 3, and 4 should add to the total in column 1.

In estimating the full-time equivalents of part-time personnel reported in item 11 use your institution's definition of such equivalents. Thus, four part-time instructors, each of whom teaches one 3-hour credit course, may be reported as one full-time equivalent in teaching, if four such credit courses were considered the load of a full-time instructor at the institution.

Section E—Number of Professional Personnel Employed in All Activities

Item 13. Number of full-time and part-time employed professional personnel in all activities, by field, January 1964 and January 1965.

Item 13a. Report data on the number of full-time and part-time professional personnel employed by the institution in science and engineering as of January 1965, or a date as close thereto as possible for which such data are available; and also for January 1964.

It should be noted that the number of professional scientific and engineering personnel reported in item 13a for January 1965 should be the same as the combined total reported in items 10g column 1 and 11g column 1.

Professional personnel are defined to include all persons employed by the institution in positions requiring an educational background of at least the Bachelor's degree. Exclude personnel employed as technicians or employed in other occupations not requiring a Bachelor's degree or the equivalent.

Item 13b. Report data on the number of full-time and part-time professional personnel employed by the institution in all fields except science and engineering for January 1964 and January 1965.

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